KENWOOD

SERVICE MANUAL

Model TS-120S
VFO-120 SP-120
PS-30 AT-120

TS-120V

INCLUDES SCHEMATIC ONLY FOR
THIS VERSION OF THE TS-120S



HF SSB TRANSCEIVER

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SPECIFICATIONS/SPECIAL COMPONENTS DATA

Frequency Range:

80 m band	3.5~4.0 MHz
40 m band	7.0~7.3 MHz
20 m band	14.0 ~ 14.35 MHz
15 m band	21.0 ~ 21.45 MHz
10 m band A	28.0 ~ 28.5 MHz
10 m band B	28.5 ~ 29.0 MHz
10 m band C	29.0 ~ 29.5 MHz
10 m band D	29.5 ~ 29.7 MHz
WWV	15.0 MHz (receive only)

Mode: SSB (A3J), CW (A1)

Power Requirements:

80 m~
15 m band .... 200W PEP for SSB operation
160W DC for CW operation
10 m band .... 160W PEP for SSB operation
140W PEP for CW operation

Antenna Impedance: 50Ω

Carrier Suppression: Carrier better than 40 dB down from the output signal.

Sideband Suppression: Unwanted sideband is better than 50 dB down from the output signal.

Mic. Impedance: 500Ω ~ 50kΩ

Audio Frequency Response: 400 ~ 2600 Hz (−6 dB)

Harmonic Radiation: Better than 40 dB down from output signal.

Receiver Sensitivity: 0.25μV for S/N 10 dB or better

Image Ratio: Image frequency better than 50 dB down from the output signal.

IF Rejection: IF frequency is 70 dB or more down from the output signal.

Frequency Stability: Within 100 Hz during any 30 minute period after warm up.
Within ±1 kHz during the first hour after 1 minute of warm up.

Selectivity: SSB, CW 2.4 kHz (−6 dB)
4.2 kHz (−60 dB)

AF Output: More than 1.5W (8Ω load, 10% distortion)

AF Load Impedance: 4 ~ 16Ω for both speaker and headphone.

Power Supply: 12 ~ 16V DC (13.8V)

Power Consumption: Less than 18A in transmit (less than 1:5 SWR ratio)

(at DC 13.8V): Less than 0.7A in receive.

Semiconductors and Tube:

IC's	26
FET's	16
Transistors	90
Diodes	142
Display Tube	1

Dimensions: W 241(241) × H 94(108) × D 235(281) mm (With Projection)

Weight: Approx. 5.6 kg (12.3 lbs)

NOTE:
The circuit and ratings may change without notice due to development in technology.

SPECIAL COMPONENTS DATA

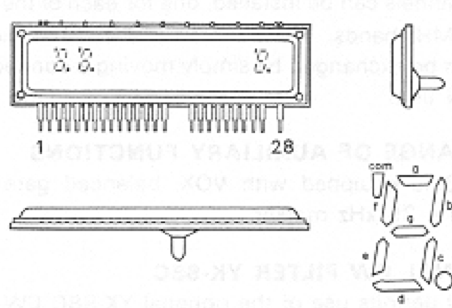
- Application
  2SC2290 (HF power amplifier) (V03-2290-06)
  NPN Epitaxial planar transistor Si
- Absolute maximum ratings

Item	Pc	VCBO	VCES	VEBO	IC	IE	Tstg
Value	175 (W) (Tc=25℃)	45 (V)	45 (V)	4.0(V)	20 (A)	−20 (A)	−65~175 (°C)

- Application
  2SC2509 (HF power amplifier) (V03-2509-06)
  NPN Epitaxial planer transistor Si
- Absolute maximum ratings

Item	Pc	VCBO	VCES	VCEO	VEBO	IC	IE	Tstg
Value	20(W) (Tc=25℃)	40(V)	40(V)	18(V)	4(V)	5(A)	−5(A)	−55~150(℃)

- Indicating tube 9-BT-12 (V40-7760-86)



PIN NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14
CONNECTION	F	Nc	G9	Nc	Nc	G8	g	f	G7	e	d	G6	Nc	Nc
PIN NO	15	16	17	18	19	20	21	22	23	24	25	26	27	28
CONNECTION	G5	Np	Np	G4	Dp	G3	c	b	G2	a	com	G1	Np	F

FEATURES/GENERAL INFORMATION/YK-88C

FEATURES

1. SINGLE CONVERSION SYSTEM USING PLL CIRCUITRY

The single conversion system, with a unique PLL Phase Locked Loop circuit, FET balanced mixers and MOS FET'S assures excellent spurious and intermodulation characteristics.

2. BUILT-IN DIGITAL DISPLAY

The digital display affords easy reading of operating frequency to an accuracy of 100 Hz, on any band and any mode.

3. BUILT-IN SHIFT CIRCUIT (Passband Tuning)

An IF SHIFT system is built in to the transceiver to allow shifting of the IF passband, thereby eliminating adjacent channel interference.

4. 3.5~29.7 MHz AND WWV BANDS

The transceiver is designed to operate on LSB/USB/CW in the 3.5~29.7 MHz bands. WWV (14.5~15 MHz) is also built in to the transceiver to permit accurate frequency calibration.

5. COMPACT, LIGHT-WEIGHT DESIGN

The TS-120 has many advanced features, yet it is compact and light-weight and suitable for mobile and field operation as well as fixed station operation.

6. EASY OPERATION

All controls and switches are carefully arranged for ease of operation, ensuring convenience and versatility.

7. ALL SOLID-STATE DESIGN

The all solid-state, compact unit features a wide band final stage, eliminating the need for peaking controls.

8. FOUR FIXED CHANNELS

Four FIX channels can be installed, one for each of the 7, 14, 21 and 28 MHz bands. The 3.5 MHz and 28 MHz fixed xtal position can be exchanged by simply moving a connector on the AF-GEN unit.

9. FULL RANGE OF AUXILIARY FUNCTIONS

The TS-120 is equipped with VOX, balanced gate noise blanker and a 25 kHz marker.

10. OPTIONAL CW FILTER YK-88C

The TS-120 permits use of the optional YK-88C CW filter. CW semi-break-in operation is provided using the built-in VOX and CW side tone circuits.

11. WIDE VARIETY OF OPTIONAL ACCESSORIES

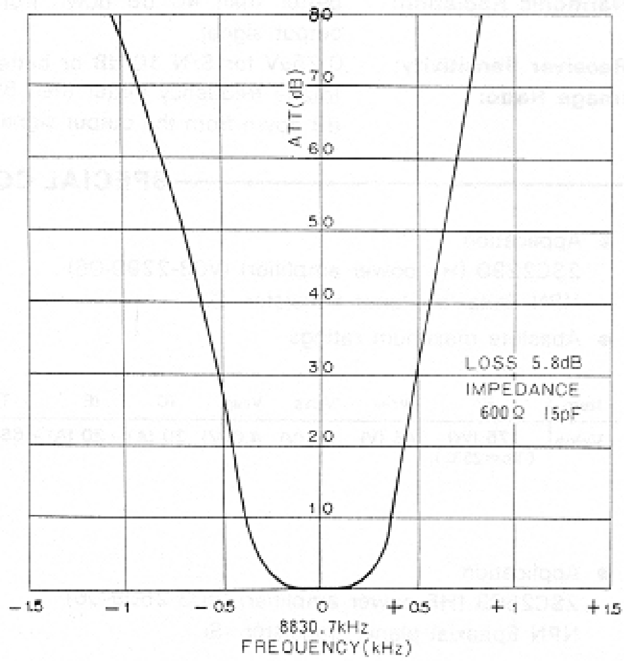
The following optional accessories are available:
Regulated Power Supply (PS-30), Mobile Mount (MB-100), CW Filter (YK-88C), External VFO (VFO-120), External Speaker (SP-120), and antenna tuner AT-120.

GENERAL INFORMATION

Page 49 shows a block diagram of the TS-120 HF Amateur transceiver. It employs a single-conversion system with PLL circuitry. The IF is 8.83 MHz.
The TS-120 features a number of unique circuits and overall high performance. It is designed so the PLL lock frequency of each band, the CAL marker signal, and the counter clock circuit use a single reference frequency crystal instead of individual crystals as found in the TS-820 series transceiver. Circuits include IF SHIFT, VOX (with semi-break-in CW), side tone, noise blanker (NB), and crystal calibrator (CAL) for convenient and versatile transceive operation.

YK-88C SPECIFICATIONS

Center frequency:	8830.7 kHz
Center frequency deviation:	Less than ±150 Hz (6 dB)
Passband width:	500 Hz −6 dB
Attenuation band width:	1.5 kHz (−60 dB)
Ripple:	Less than 2 dB
Minimum loss:	6 dB ±2 dB
Guarranteed attenuation:	Less than ±2 kHz ~ ±1 MHz More than 80 dB
Terminal impedance:	600Ω ±5%, 15pF ±5%



YK-88C filter attenuation characteristic

CIRCUIT DESCRIPTION

RECEIVING CIRCUIT

The signal from the antenna is fed to the 8.83 MHz IF trap circuit. This signal is stepped up about 10 dB and impedance-converted by a wide-band transformer before it is applied to the bandpass filter (BPF). The BPF is common to transmission and reception, eliminates the need for a preselector, and makes the RF section compact in design.
The signal from the BPF is fed to the dual-gate MOS FET wideband RF amplifiers consisting of a 3SK74 (Q1) and a 2SC1815 (Q2), where the 2 MHz to 35 MHz signal is amplified about 20 dB.
The RF amplifier output passes through a wide-band transformer to the input balanced transformer of the balanced mixer (two 3SK74s, Q3 and Q4), where it is mixed with the VCO output from the PLL and converted to the 8.83 MHz IF. This signal is applied to the IF unit, through the ceramic filters, NB gate circuit and the crystal filter. The NB circuit is controlled by the NB switch on the front panel.
The signal, passing through the crystal filter, is amplified about 90 dB by the three-stage 3SK74 MOS FET IF amplifier (Q1, Q2, and Q3) and is demodulated into audio by the four-diode ring detector.
From the final IF stage, the signal also passes through a buffer amplifier and is fed to the AGC circuit where it is detected and amplified. Receiver gain is controlled by this AGC voltage applied to the second gates of the RF and IF amplifiers, with the time constant determined by R38 (2.2MΩ) and C40 (1μF). Input levels of 2 dB and 34 dB are indicated as S1 and S9 on the S-meter. The AF signal is amplified by Q1, a 2SC2240 (GR), gain controlled, and further amplified by an HA1366W (Q7), the power-amplifier IC, to to drive the speaker. This signal, which is transistor-coupled with Q14, a 2SC1815(Y), and Q15, a 2SA1015(Y), is sampled for ANTI-VOX control, so the VOX circuit is not tripped by the speaker output. This new system is a departure from the conventional transformer-coupled sampling systems.

TRANSMITTING CIRCUIT

The microphone signal is amplified by transistors Q18, a 2SC2240(GR), Q10, and Q11, each a 2SC1815(Y), and is fed to the four-diode balanced modulator (BM) circuit. Microphone impedance is 500Ω to 50kΩ.
The 8.83 MHz DSB signal from the BM is amplified about 10 dB by Q12, a 2SK19 FET, and is fed to the IF unit where the unwanted sideband is removed by the crystal filter to produce an SSB signal. The gate of Q12 is also controlled by the protection voltage which is developed when the transmitter output looks into an incorrect load, continuously reducing output power. The SSB signal from the crystal filter is amplified about 30 dB by the 3SK74 IF amplifier (Q1), and is fed to the transmit 3SK74 MOS FET balanced mixer (Q5 and Q6), where it is mixed with the VCO output and converted to the final transmit frequency.
Unwanted spurious components are eliminated by the transmit/receive BPF circuit, and the signal is wideband-amplified by Q7, Q8 (2SC1815), and Q9 (2SC2086).
In the final unit, the signal is amplified by the 2SC2075 driver (Q1), and by the 2SC2509 push-pull power amplifiers (Q2 and Q3). Then the signal is amplified by the 2SC2290 push-pull power amplifiers (Q4, 5). The signal then passes through an RF filter and is fed to the antenna.
Antenna output is toroid-sampled to detect the forward and reflected power. The forward power is used for ALC and the reflected power for protection. Forward power is fed to the second gate of the 3SK74 transmit/receive IF amplifier (Q1), with a time constant determined by R4 (1.5 MΩ) and C25 (0.47 μF). For CW operation, block bias keying controls the base circuit of the 2SA1015 switching transistor (Q10) in the RF circuit. Q10 controls the first and second gate voltages of the transmit mixer (Q5 and Q6) and the base voltage of the predriver (Q9).

FUNCTIONAL DESCRIPTION

TS-120S FREQUENCY SYSTEM

The TS-120S employs single conversion with a unique PLL circuit, as shown in Fig. 1.

The frequency system is basically that of the TS-820 with the exception of the PLL circuit.

PLL CIRCUIT

VCO output is obtained by synthesizing the 10 MHz and 500 kHz reference, from the counter, and the VFO and CAR instead of a separate HET crystal circuit for each band the TS-120 uses the counter reference oscillator, and a programmable divider circuit contained in the PLL. This simplifies circuit design and eliminates changes in transmit/receive frequency due to HET crystal frequency deffrences. Fig. 2 shows PLL circuit construction and Table 1 shows the frequency in each circuit.

Referring to Fig. 1, MIX (3) combines CAR and VFO signals and is operated straight through to mixer (1) on 3.5 and 7 MHz. MIX (2) operates at 14 MHz and above with the output of MIX (3) to provide mixer (1) input, as shown in Table 1. MIX (1) output is filtered, amplified, shaped and divided by the programmable divider to obtain 500 kHz output.

The programmable divider converts the information from the band switch into a BCD signal in the counter. By presetting, the signal is divided at the ratio shown in Table 1. The phase comparator is a Motorola MC4044P. The loop filter amplifier, component transistors, minimizes unwanted spurious signal. If output of the phase comparator unlocks for any reason, VCO output is switched off to prevent out of band emission and, simultaneously the digital display blanks.

CAR OSCILLATOR

The CAR oscillator contains one oscillator and two crystals for LSB, USB, and CW operation. The oscillator frequency in each mode is listed in Fig. 1.

Oscillator frequency can be varied by the IF SHIFT control during reception.

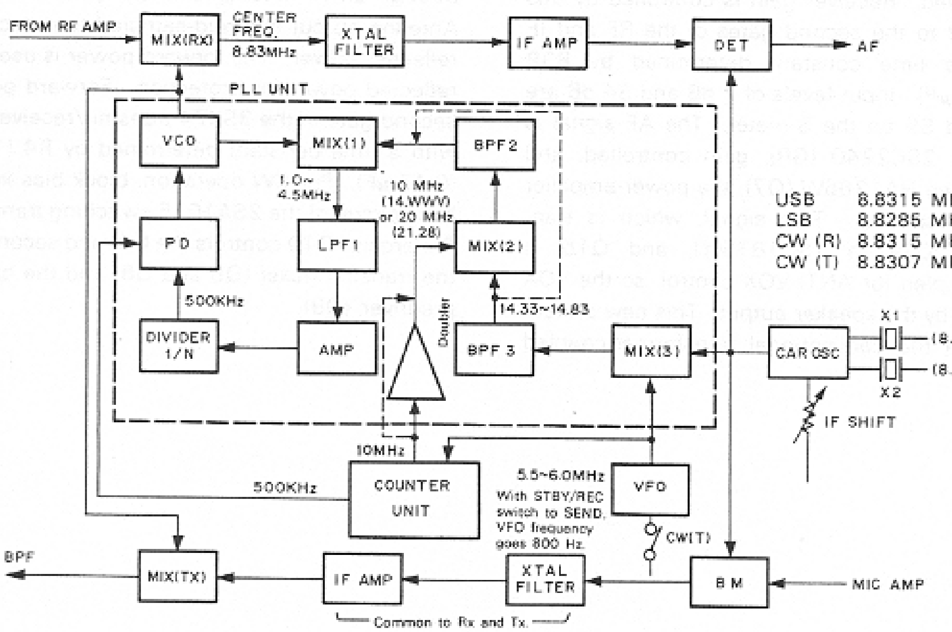


Fig. 1 TS-120 Frequency configuration

FUNCTIONAL DESCRIPTION

Band	RX, TX Frequency	VCO	MIX(1) Input	MIX(1) Output	Divider	D C B A
WWV	14.5 ~15.0	23.33 ~23.83	24.33 ~24.83	1.0	1/2	1 1 1 0
3.5	3.5 ~4.0	12.33 ~12.83	14.33 ~14.83	2.0	1/4	1 1 0 0
7	7.0 ~7.5	15.83 ~16.33	14.33 ~14.83	1.5	1/3	1 1 0 1
14	14.0 ~14.5	22.83 ~23.33	24.33 ~24.83	1.5	1/3	1 1 0 1
21	21.0 ~21.5	29.83 ~30.33	34.33 ~34.83	4.5	1/9	0 1 1 1
28	28.0 ~28.5	36.83 ~37.33	34.33 ~34.83	2.5	1/5	1 0 1 1
28.5	28.5 ~29.0	37.33 ~37.83	34.33 ~34.83	3.0	1/6	1 0 1 0
29	29.0 ~29.5	37.83 ~38.33	34.33 ~34.83	3.5	1/7	1 0 0 1
29.5	29.5 ~30.0	38.33 ~38.83	34.33 ~34.83	4.0	1/8	1 0 0 0

Table 1 The frequency chart

VFO OSCILLATOR

The TS-120 VFO oscillator has been developed on the basis of the TS-820 and TS-520 VFO. It is physically smaller, and its operating frequency has been raised to cover 5.5 to 6.0 MHz.

During CW operation, transmit frequency is shifted approx. 800 Hz above the receive frequency. CW shift is also digitally displayed.

The main tuning dial covers 25 kHz per revolution and is calibrated at 1 kHz intervals. A 10 kHz subscale is also provided. The operating frequency can be read easily from either the analog or digital display.

DIGITAL COUNTER

The TS-120 digital counter employs a VFO frequency counting system as shown in Fig. 3.

The VFO frequency is mixed with a 5 MHz signal obtained from the reference oscillator chain by a 3SK73 (Q7) and is coverted to a 1 MHz signal. This signal passes through the LPF, is amplified, buffered and shaped into a square wave, passes through the 0.1 second gate circuit and is applied to the four-digit counter. The signal is counted from 10 Hz to 100 kHz and fed to the preset counter deriving the carrier output.

The 100 kHz order digit presets "5" or "0" to display the operating frequency.

The 1 MHz and 10 MHz order digits are composed by diode matrix operating on bandswitch information.

The counter outputs are switched by the multiplexer and are converted from BCD to seven-segment information by the decoder to light the fluorescent display tube.

The 10 MHz signal from the time-base reference oscillator is divided to produce gate, latch, and reset pulses which are fed to the counter. The 10 MHz and 500 kHz signals are fed to the PLL circuit.

The marker circuit produces a 100 kHz signal which synchronizes the 25 kHz multivibrator to obtain a marker signal as accurate as the reference frequency. The analog dial can be accurately calibrated to the marker signal.

The 1/10 division at the first-stage count-down chain uses low-power Schottky TTL, while the remaining divisions are made by a CMOS IC for low power consumption and minimum spurious emission.

Because of the IF SHIFT circuit, the CAR frequency is independent of the transmit/receive frequency. Once the VFO

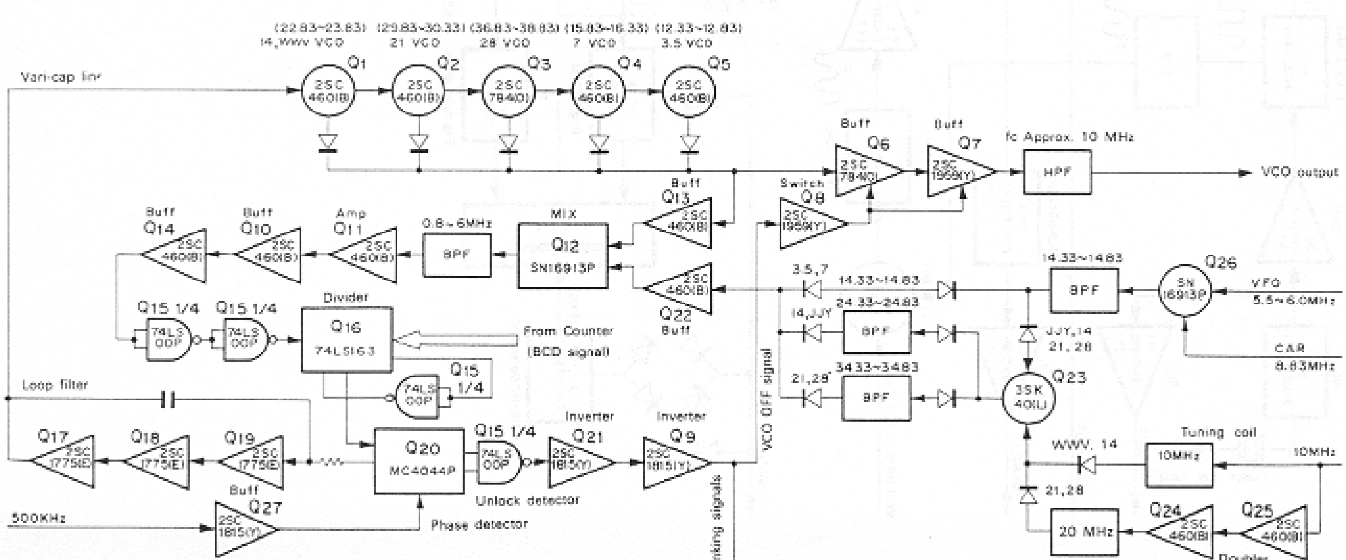


Fig. 2 TS-120 PLL circuit configuration

FUNCTIONAL DESCRIPTION

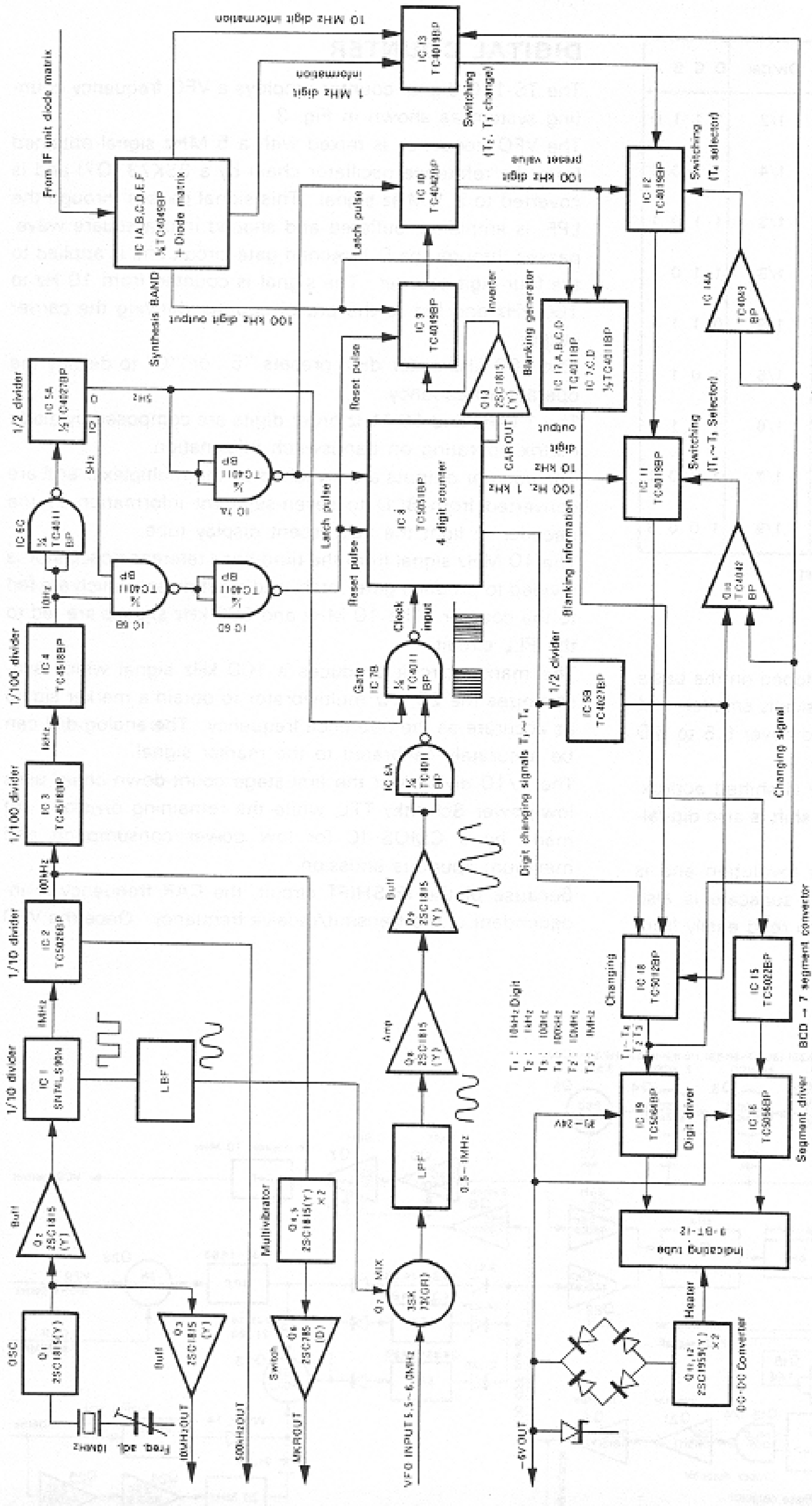


Fig. 3 TS-120 Counter circuit configuration

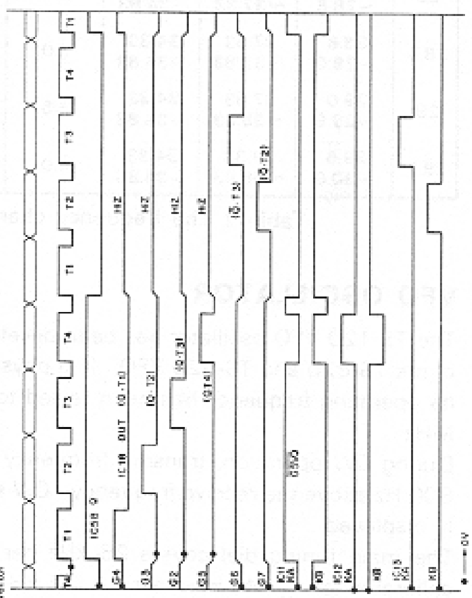


Fig. 4 Timing chart

FUNCTIONAL DESCRIPTION

frequency is counted, the operating frequency is indicated as accurately as the 10 MHz reference oscillator frequency is calibrated to WWV. Operating frequency is indicated accurate to the 100 Hz order, regardless of the band or mode. If the VFO output varies (beyond the band edge the 1 and 10 MHz digits disappear and a blanking signal is developed.

Operating band	Blanking frequencies
3.5 MHz	more than 4.000.0 MHz
7.0 MHz	less than 7.000.0 MHz
14.0 MHz	less than 14.000.0 MHz
21.0 MHz	less than 21.000.0 MHz
28.0 MHz	less than 28.000.0 MHz
28.5 MHz	more than 29.000.0 MHz
29.0 MHz	less than 29.000.0 MHz
29.5 MHz	more than 30.000.0 MHz

PROTECTION CIRCUIT

Fig. 5 shows the TS-120 protection circuit. When the transmit output load varies, the toroid in the final circuit samples reflected power. It is then rectified and amplified, producing a protection voltage to control the 2SK19 (Q12) on the AF-GEN unit, so transmitter output is continuously reduced.

FILTER UNIT

1. ALC: Protection circuit (VSWR)

The protection voltage picked up by L18 in the filter unit is amplified by Q1 (2SC1815), then applied to the ALC line to control the output voltage.

The ALC voltage is amplified by Q3 (2SC1815). For the 28 MHz band, the output power is lowered to 50W by applying BAND information to the B terminal so that Q2 controls the emitter voltage of Q3. For mobile operation, the power output is lowered to 50W in all bands by grounding the PO terminal of the filter unit so that the power down circuit for 28 MHz band is operated.

2. Fan drive circuit

The output of the thermistor detecting the temperature of the final unit is applied to Q6 (2SA562) via Q7 and Q8, so that Q6 is switched to operate the fan. The fan starts to rotate at about 45°C although the operating range shown in specification is 30～60°C. It stops when the temperature drops to a level 5～15°C lower the start temperature. This circuit operates regardless of transmission or reception because it detects the temperature of the heat sink.

3. AVR circuit

The 11V AVR consists of Q4, Q5 and Q6. The regulated voltage is supplied to every unit except for the fan drive circuit during transmission. The fan drive circuit is always supplied with the regulated voltage regardless of transmission or reception.

4. Filter circuit

The filter is a 2-stage constant K filter (3-stage for 3.5 MHz band).

FINAL UNIT

1. Temperature protection

1 Core temperature protection
operates when the output transformer temperature exceeds 120°C.

2 Operates when the heat sink temperature exceeds 90°C because of some defect.
When either of the above protection systems operate, the RL circuit in the AF GEN unit is turned OFF and the unit is forcibly placed in the reception mode and transmission is inhibited. The protection circuit automatically recovers when the temperature drops to the normal level (i.3., the temperature drops by about 40°C).

2. Temperature detection by the fan drive circuit

The heat sink temperature is detected by the thermistor TH3 to control fan operation.

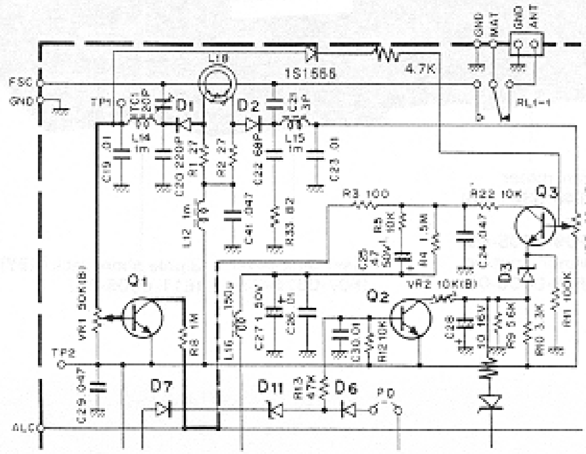
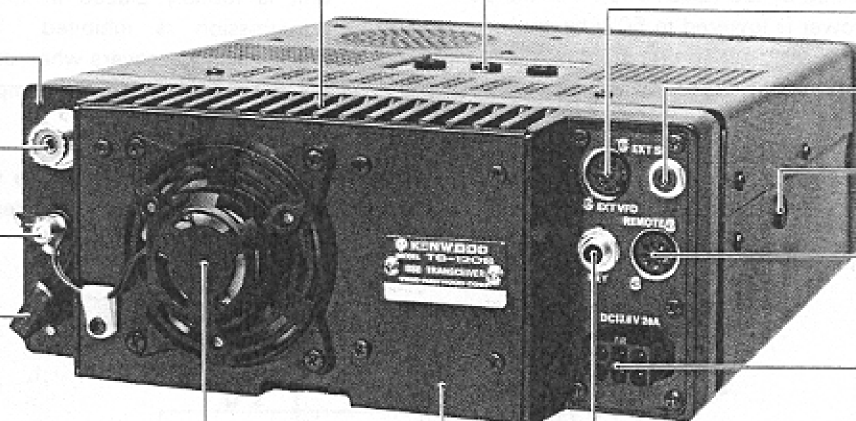


Fig. 5 TS120 Protection circuit

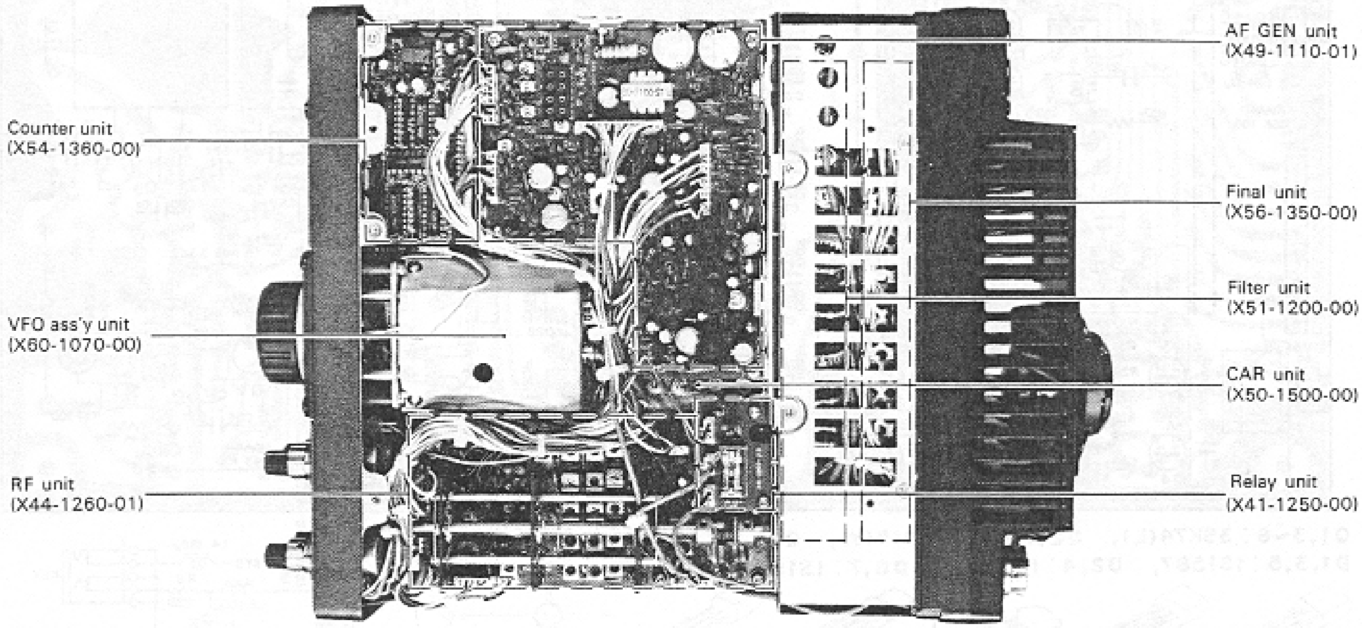
OUTSIDE VIEWS



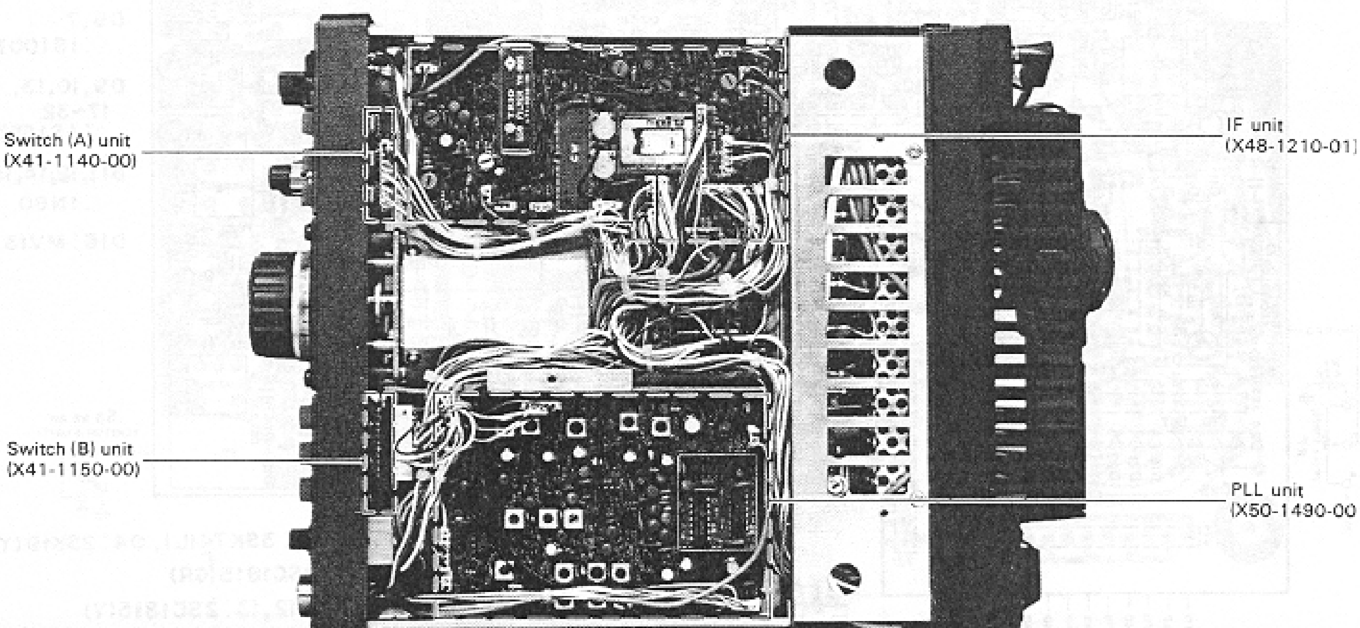


INSIDE VIEWS

TOP VIEW

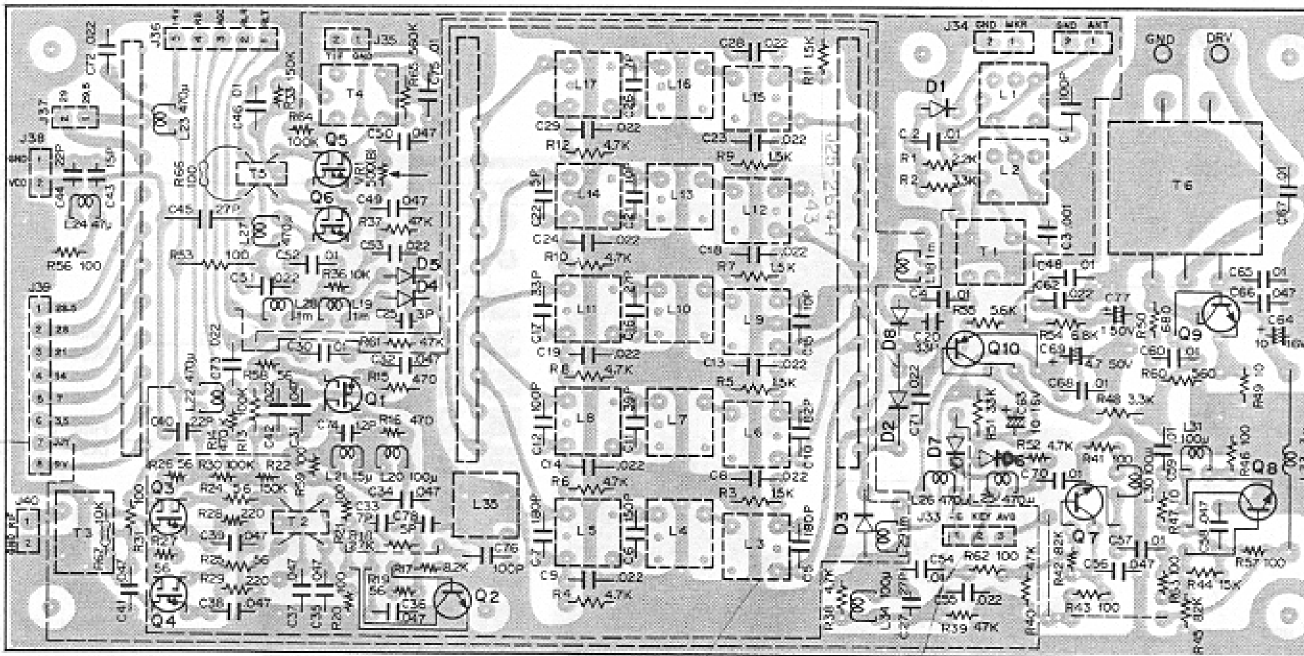


BOTTOM VIEW

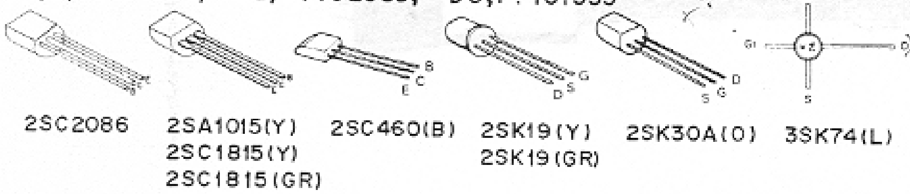


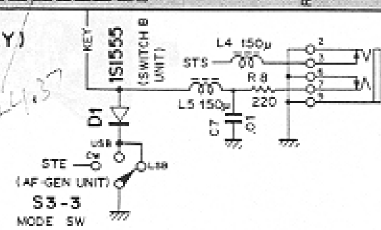
PC BOARD VIEWS

▼ RF UNIT (X44-1260-01)

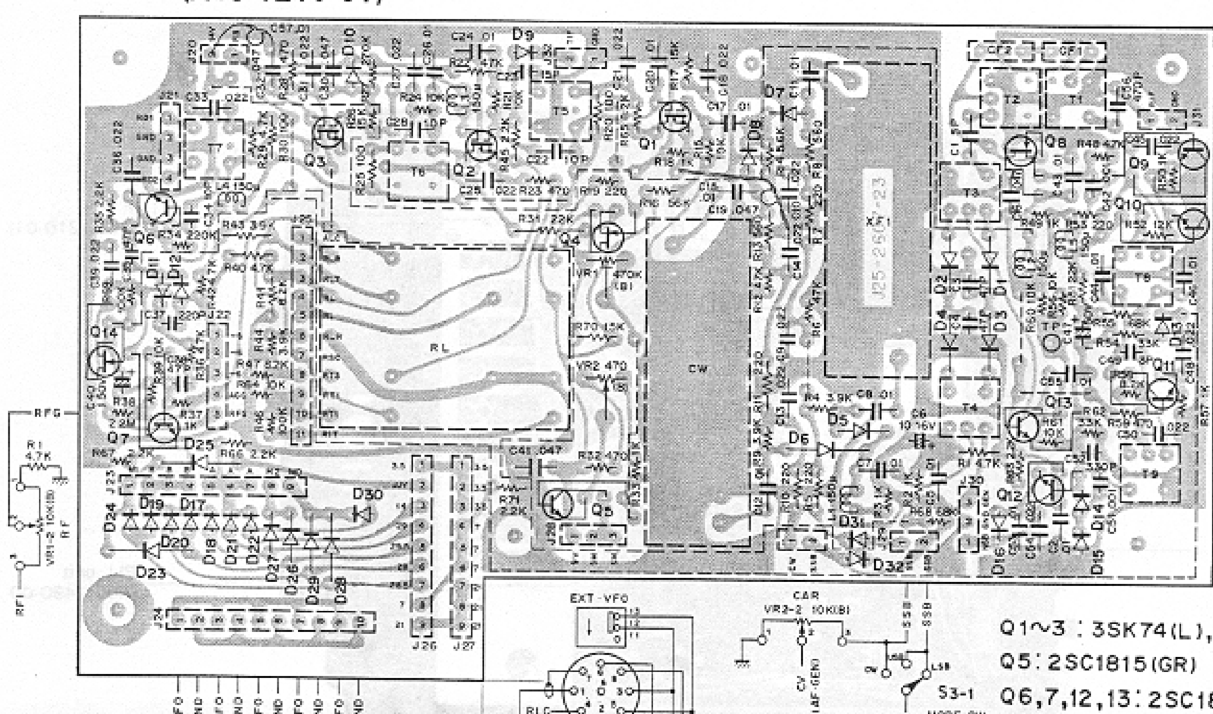


Q1,3~6 : 3SK74(L), Q2,7,8 : 2SC1815(Y), Q9 : 2SC2086, Q10 : 2SA1015(Y)
D1,3,5 : 1S1587, D2,4 : 1S2588, D6,7 : 1S1555





▼ IF UNIT (X48-1210-01)

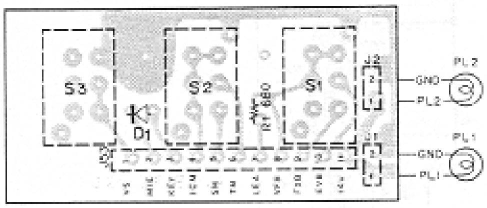


D1~4,6,8 : 1S1587
D5,7 : 1S1007
D9,10,13, 17~32 : 1S1555
D11,12,14,15 : 1N60
D16 : MV13

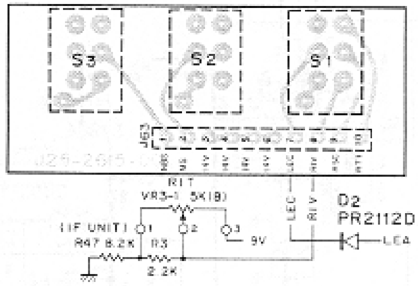
Q1~3 : 3SK74(L), Q4 : 2SK19(Y)
Q5 : 2SC1815(GR)
Q6,7,12,13 : 2SC1815(Y)
Q8 : 2SK19(GR)
Q9~11 : 2SC460(B), Q14 : 2SK30A(O)

PC BOARD VIEWS

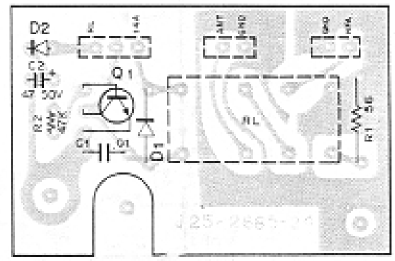
▼ SWITCH (B) UNIT (X41-1150-00)



▼ SWITCH (A) UNIT (X41-1140-00)

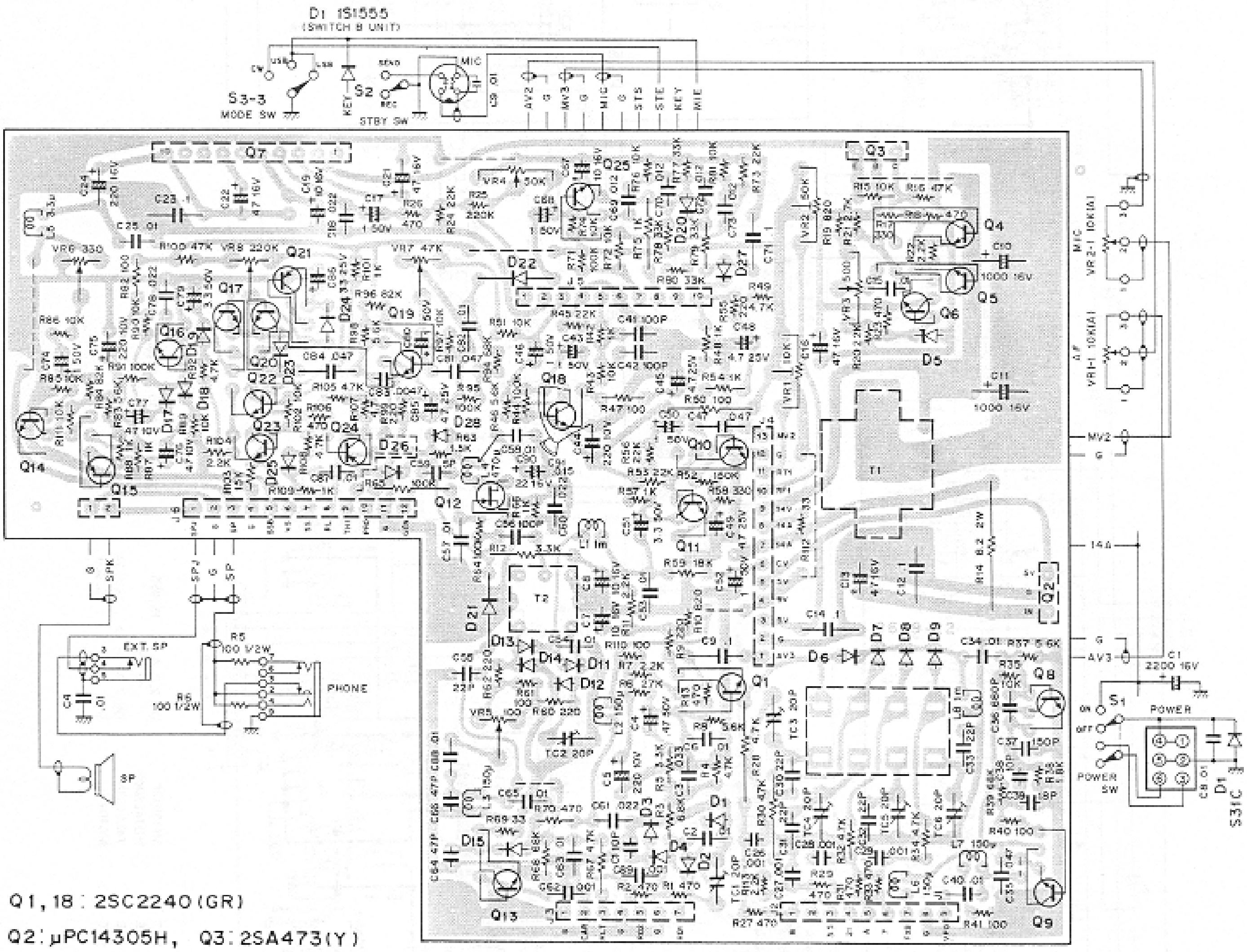


RELAY UNIT (X41-1250-00)



Q1 : 2SC1959(Y) D1,2 : 1S1555

▼ AF, GEN UNIT (X49-1110-00)



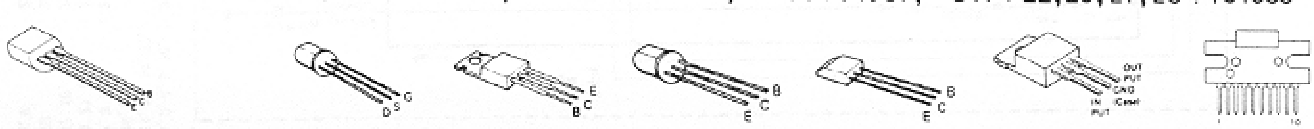
Q1, 18 : 2SC2240(GR)

Q2 : μPC14305H, Q3 : 2SA473(Y)

Q4~6, 10, 11, 14, 16, 17, 19, 20, 23, 25 : 2SC1815(Y), Q7 : HA1366W, Q8, 13 : 2SC460(B), Q9 : 2SC1959(Y)

Q12 : 2SK19(GR), Q15, 21 : 2SA1015(Y), Q22 : 2SC1815(GR), Q24 : 2SA562(Y)

D1~4, 11~14, 23, 24, 26 : 1N60, D5 : WZ-061, D6~9 : 1S2588, D15 : 1S1587, D17~22, 25, 27, 28 : 1S1555

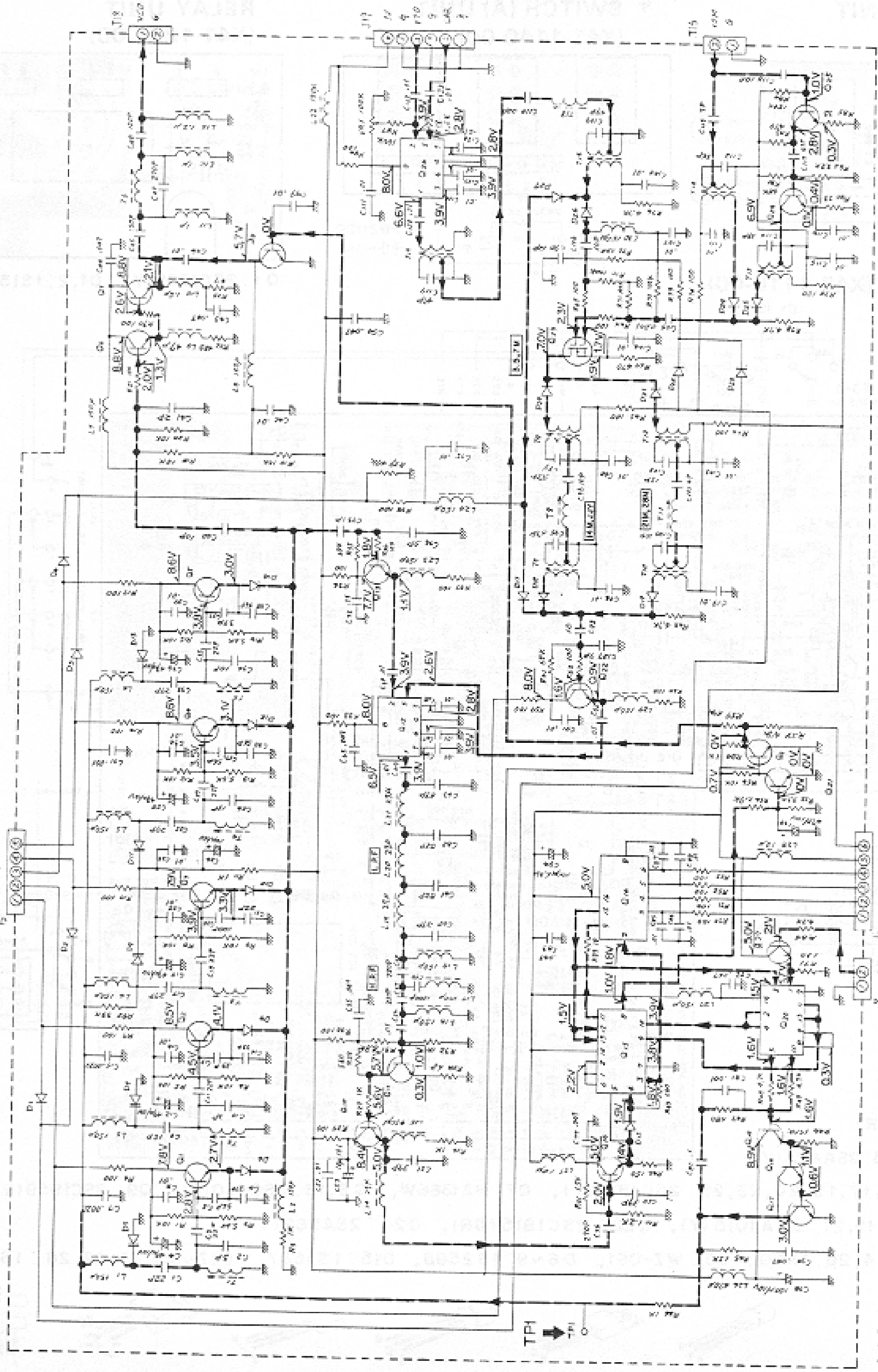


2SA1015(Y) 2SC1959(Y)
2SC1815(Y) 2SC2240(GR)
2SC1815(GR)

2SK19(GR) 2SA473(Y) 2SA562(Y) 2SC460(B) μPC14305H HA1366W

CIRCUIT DIAGRAM

▼ PLL UNIT (X50-1490-00)



Q1, 2, 4, 5, 10, 11, 13, 14, 22, 24, 25 : 2SC460(B)
Q7, 8 : 2SC1959(Y)
Q9, 21, 27 : 2SC1815(Y)
Q17, 18, 19 : 2SC1775(E)
Q23 : 3SK40(L)
Q3, 6 : 2SC784(O)

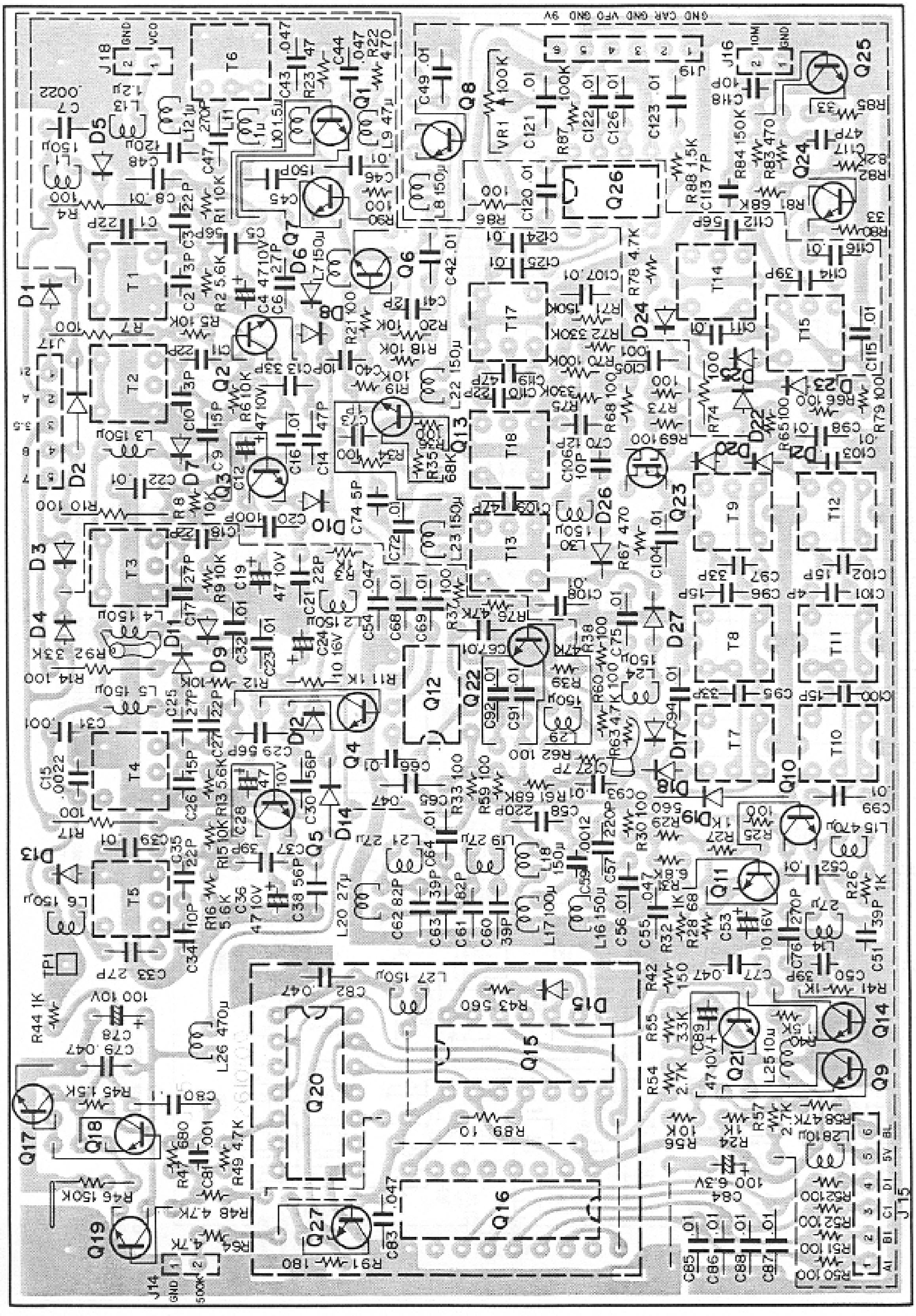
Q12, 26 : SN16913P
Q15 : HD74LS00P
Q16 : 74LS163N
Q20 : MC4044P

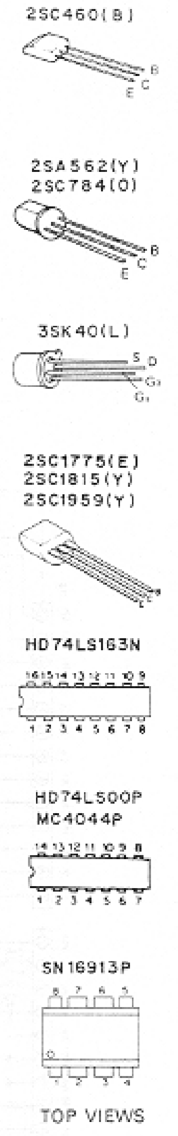
D1, 2, 3, 4, 22, 23 : 1S1555
D5, 7, 9, 11, 13 : 1SV53A
D10 : 1S2588

D6, 8, 12, 14, 17, 18, 19, 20, 21, 24, 25, 26, 27, 15 : 1S1587

PC BOARD VIEWS

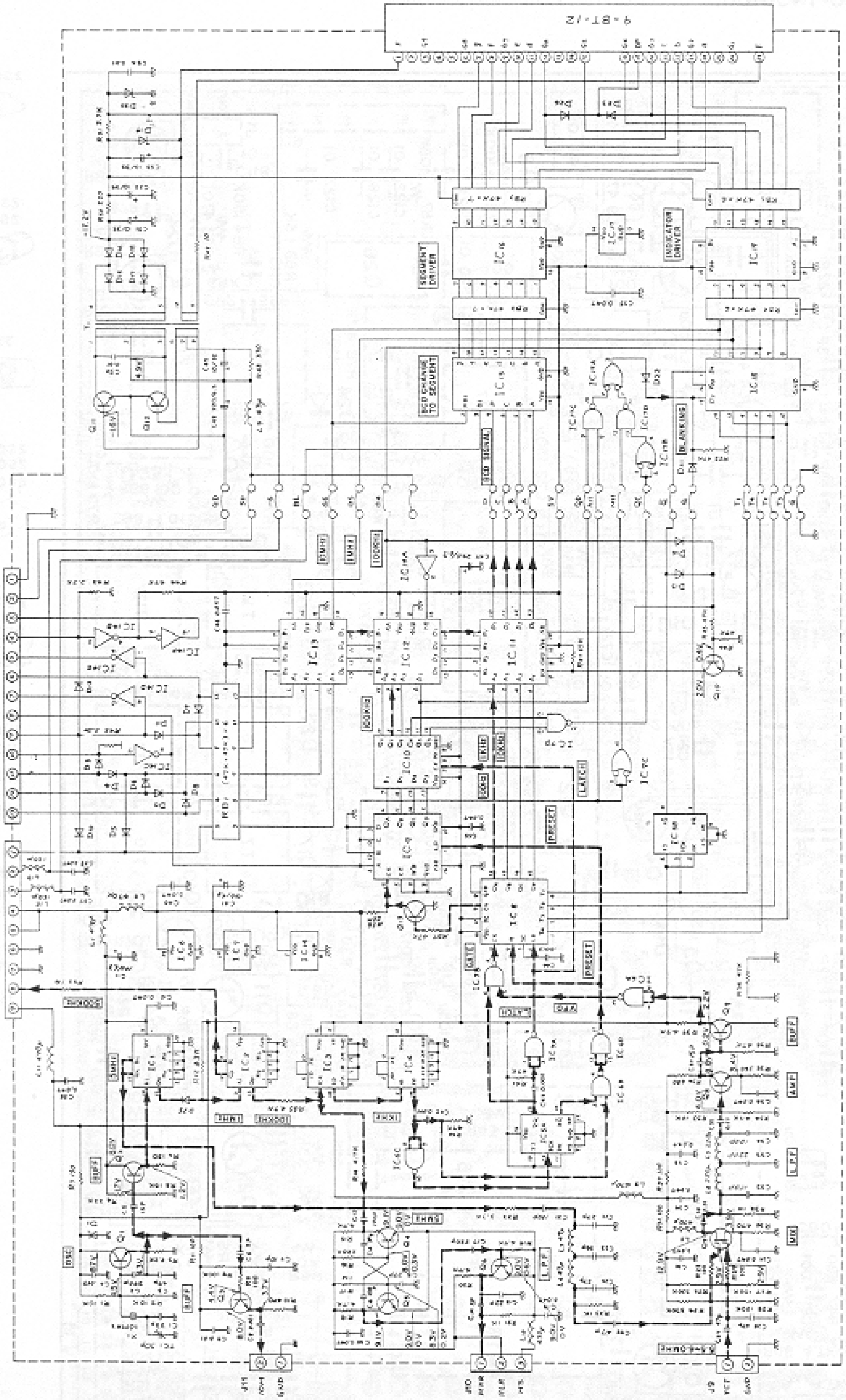
▼ PLL UNIT (X50-1490-00)





CIRCUIT DIAGRAM

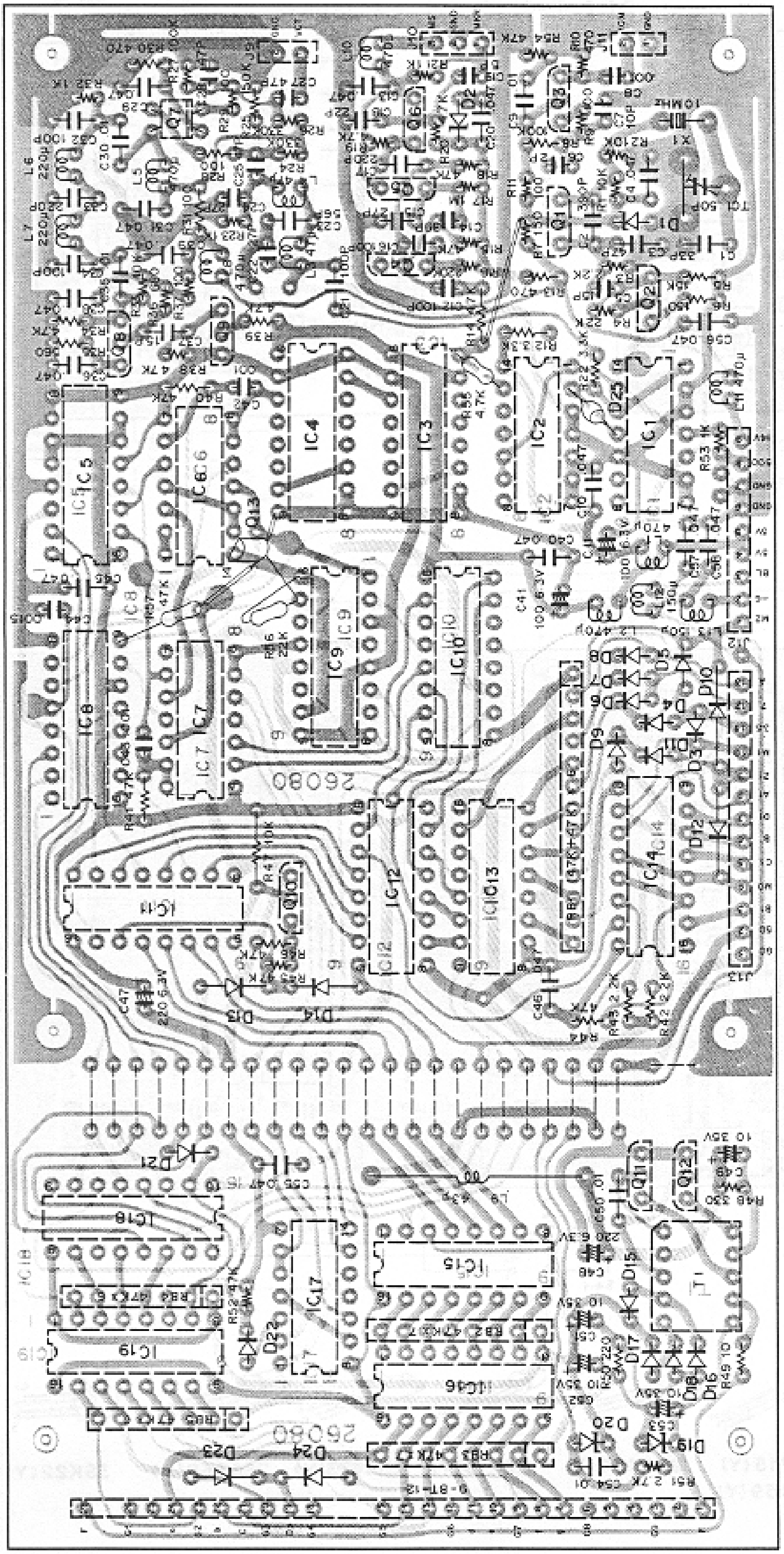
▼ COUNTER UNIT (X54-1360-00)



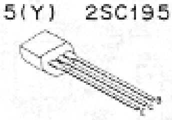
Q1, 2, 3, 4, 8, 9, 10, 13 : 2SC1815(Y)
Q7 : 3SK73(GR)
Q11, 12 : 2SC1959(Y)
Q6 : 2SC785(O)
Q5 : 2SC1815(GR)
D1, 19 : WZ-090
D3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 21, 22, 23, 24 : 1S1555
D20 : XZ-060
D25 : MV-13
IC1 : SN74LS90N
IC2 : TC5026BP
IC3, 4 : TC4518BP
IC5 : TC4027BP
IC6, 7, 17 : TC4011BP
IC8 : TC5051BP
IC9 : TC4020BP
IC10 : TC4042BP
IC11, 12, 13 : TC4019BP
IC14 : TC4049BP
IC15 : TC5022BP
IC16 : TC5068BP
IC18 : TC5012BP
IC19 : TC5064BP

PC BOARD VIEWS

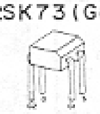
▼ COUNTER UNIT (X54-1360-00)



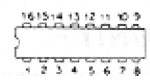
2SC785(O) 2SC1815(GR)
2SC1815(Y) 2SC1959(Y)



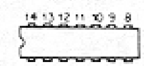
2SK73(GR)



TC4019BP TC5012BP
TC4027BP TC5022BP
TC4029BP TC5051BP
TC4042BP TC5064BP
TC4049BP TC5066BP
TC4518BP



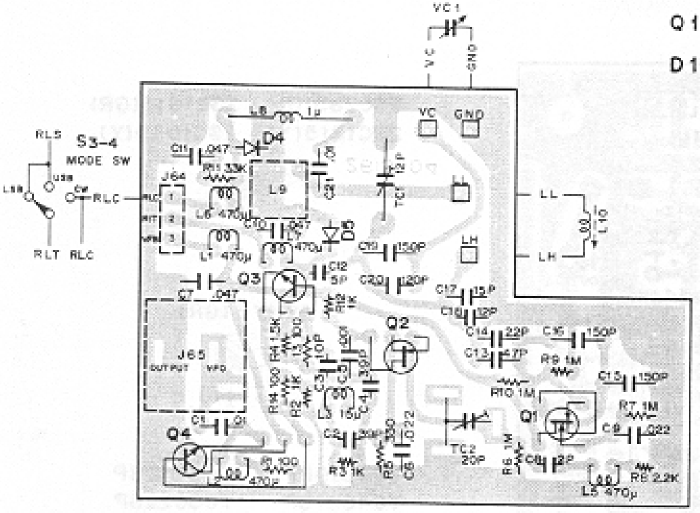
SN74LS90N TC5026BP
TC4011BP



TOP VIEWS

PC BOARD VIEWS

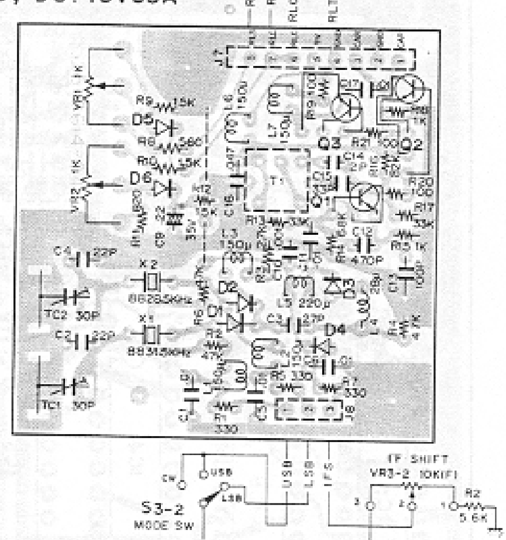
▼ VFO UNIT (X40-1130-00)



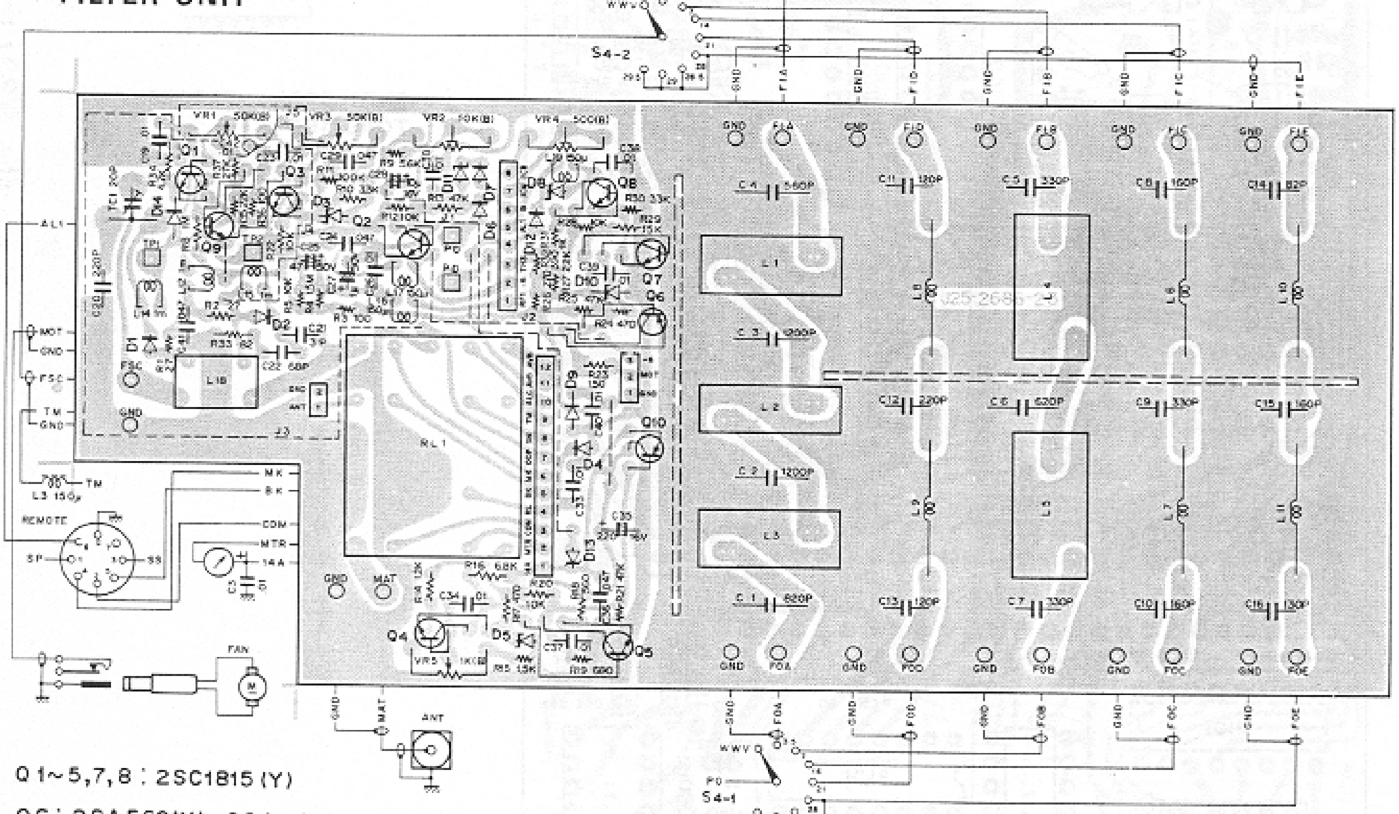
Q1: 3SK22(Y), Q2: 2SK19(Y), Q3: 2SC460(B)
Q4: 2SC1959(Y), D4: 1S2588, D5: 1SV53A

▼ CARRIER UNIT (X50-1500-00)

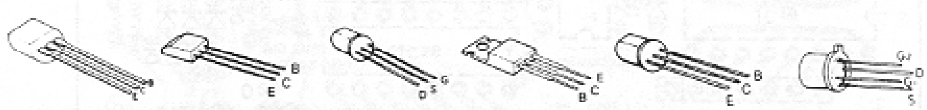
Q1,2: 2SC460(B), Q3: 2SC1959(Y)
D1,2,4~6: 1S1555, D3: 1SV53A



▼ FILTER UNIT



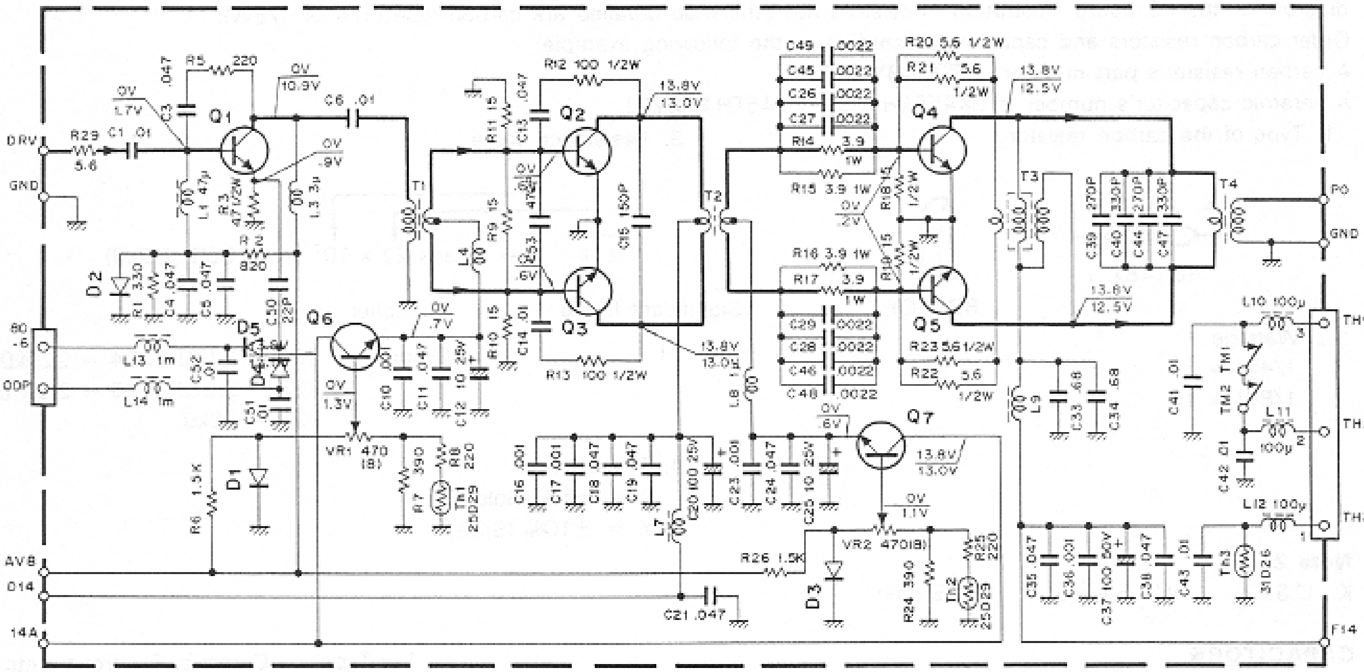
Q1~5,7,8: 2SC1815(Y)
Q6: 2SA562(Y), Q9: 2SA473(Y)
D1,2: 1N60, D3: WZ-044
D4,6,7,9,12: 1S1555
D5,10: WZ-061, D8,11,13: WZ-090



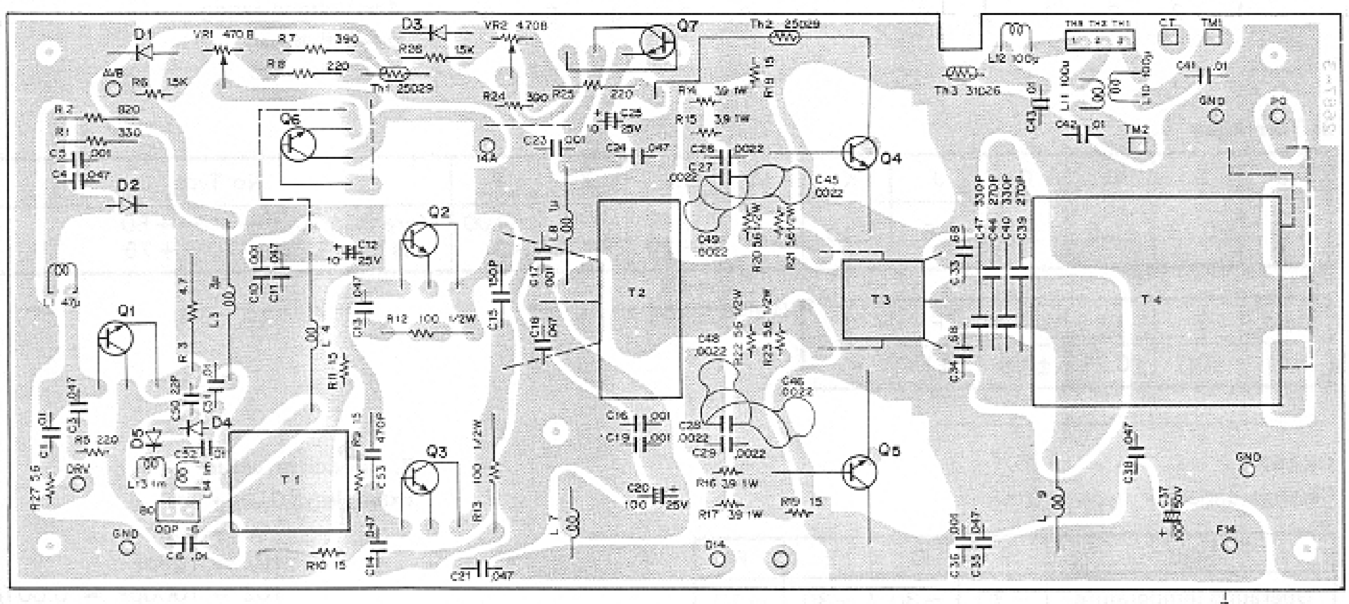
2SC1815(Y) 2SC460(B) 2SK19(Y) 2SA473(Y) 2SA562(Y) 3SK22(Y)
2SC1959(Y)

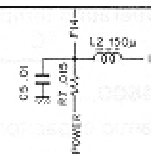
PC BOARD VIEWS/CIRCUIT DIAGRAM

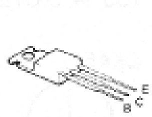
▼ FINAL UNIT (X56-1350-00)



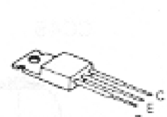
Q1 : 2SC2075
Q2,3 : 2SC2509
Q4,5 : 2SC2290
Q6,7 : 2SD235(Y)
D1,3 : SV-03
D2 : SV-4A
D4,5 : 1N60



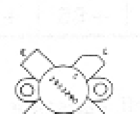




2SC2075 2SD235(Y)



2SC2509



2SC2290

PARTS LIST

Note 1:

Only special type of resistors (example: cement, metal film, etc.) and capacitors (example: electrolytic, tantalum, mylar, temp. coeff. capacitors) are detailed in the PARTS LIST. Forthe to value of all common type components refer to the schematic diagram or the PC board illustration. Resistors not otherwise detailed are carbon type (1/4 of 1/8W).

Order carbon resistors and capacitors according to the following example:

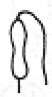
A carbon resistor's part number is RD14BY 2E222J.

A ceramic capacitor's number is CK45F1H103Z, CC45TH1H220J.

1. Type of the carbon resistor



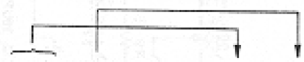
RD14BY



RD14CY

2. Wattage
   1/4W → 2E
   1/8W → 2B

3. Resistance value



② ② ② → means 22 × 10^2 = 2200Ω (2.2kΩ)

Significant figure Multiplier

Example: 221 → 220Ω 224 → 220kΩ
222 → 2.2kΩ 225 → 2.2MΩ
223 → 22kΩ

4. Tolerance
   J = ±5% (Gold)
   K = ±10% (Silver)

Note 2:

K: U.S.A. W: Europe T: Britain

CAPACITORS

Type I

CK	45	F	1H	103	Z
1	2	3	4	5	6

Type II

CC	45	TH	1H	220	J
1'	2	3'	4	5	6

1 = Type ..... Ceramic, Electrolytic etc.
2 = Shape ..... Round, Square etc.
3 = Temp range
3' = Temp coeff
4 = Voltage rating
5 = Value
6 = Tolerance

6. Tolerance

Type	C	D	G	J	K	M	X	Z	P	No Type
(%)	±0.25	±0.5	±2	±5	±10	±20	+40 −20	+80 −20	+100 −0	More than 10μF −10～+50 Less than 4.7μF −10～+75

Cord	B	C	D	F	G
(pF)	±0.1	±0.25	±0.5	±1	±2

(Value less than 10 pF)

CK45F

Ceramic capacitor (type I) 3

3

Cord	B	D	E	F
Operating temperature °C	−30 +85	−30 +85	−30 +85	−10 +70

5. Capacitor value

Example: 010 → 1pF
100 → 10pF
101 → 100pF
102 → 1000pF = 0.001μF
103 → 0.01μF

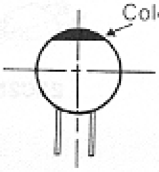
CC4500....

Ceramic capacitor (type II) temperature coeff. capacitor 1' 3'

3'

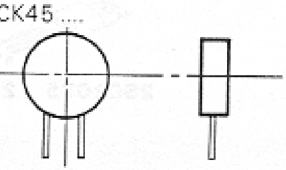
Color	CH (Black)	LH (Red)	PH (Orange)	RH (Yellow)	SL (Green)	TH (Blue)	UH (Violet)
ppm/°C	0	−80	−150	−220	−330	−470	−750

CC45 ....



Type II

CK45 ....



Type I

PARTS LIST

☆ New parts

Ref. No.	Parts No.	Description	Re-marks
GENERAL			
		CAPACITOR	
C1	C90-0806-05	Electrolytic 2200μF 16WV	
C3～9	CK45F1H103Z	Ceramic 0.01μF +80%−20%	
		RESISTOR	
R1～3	RD14BB2EOOOJ	Carbon resistor OOOΩ ±5% 1/4W	
R5,6	RC05GF2H101J	Solid resistor 100Ω ±5% 1/2W	
R7	R92-0620-00	Cementresistor 15 mΩ	
		SEMICONDUCTOR	
D1	V11-2163-05	Diode S31C	
D2	V11-7260-66	LED PR212D	
D3	V11-0240-05	Zener diode WZ-090	
		POTENTIOMETER	
VR1	R06-9402-05	10kΩ (A) AF	
		10kΩ (B) RF	
VR2	R06-9402-05	10kΩ (A) MIC	
		10kΩ (B) CAR	
VR3	R06-9403-05	5kΩ (B) RIT	
		10kΩ (F) IF SHIFT	
		MISCELLANEOUS	
S1	S36-2402-05	See saw switch POWER	
S2	S44-2402-05	Paddle switch STBY	
S3	S01-2417-05	Rotary switch MODE	
S4	S01-2417-15	Rotary switch BAND	
L2～5	L40-1511-03	Ferri-inductor 150μH	
—	A01-0743-02	Case (A) upper	☆
—	A01-0744-02	Case (B) Lower	☆
—	A20-2349-03	Panel ass'y	☆
—	B05-0701-04	Speaker grill cloth	
—	B10-0613-04	Front glass (B)	
—	B20-0811-04	Dial scale (B)	
PL1,2	B30-0808-05	Pilot lamp × 2	
—	B31-0618-05	Meter	
—	B39-0407-04	Spacer × 2 for leg	
—	B42-1644-00	Indicating plate (VOX)	
—	B42-1659-14	Indicating plate (ADJUSTMENT)	
—	B43-0620-04	Name plate (T)	☆
—	B43-0621-04	Name plate (W)(K)	☆
—	B50-2643-00	Operating manual (W)(K)	☆
—	B50-2644-00	Operating manual (T)	☆
—	B51-0877-00	Service manual (K)(W)(T)	☆
—	D21-0807-05	Band shaft	
—	D22-0404-05	Universal joint	
—	D40-0603-04	Gear Ass'y	
—	E04-0152-05	M type receptacle ANT	
—	E06-0252-05	2P metal socket (Power supply)	
—	E06-0451-05	4P metal socket MIC	
—	E06-0751-05	7P DIN socket REMOTE (ACSY)	
—	E06-0851-05	8P DIN socket EXT. VFO SW	
—	E07-0751-05	7P DIN plug REMOTE	
—	E11-0005-15	3 pole phone jack KEY	
—	E11-0034-25	PHONES jack	
—	E11-0402-05	EXT.SP jack	
—	E12-0001-05	Phone plug EXT.SP (ACSY)	
—	E22-0207-05	Lug plate 101B	
—	E22-0405-05	Lug plate × 3 202B	
—	E29-0407-05	Bridge connector	

Ref. No.	Parts No.	Description	Re-marks
—	E30-1632-05	Fan Cable (with DC cord)	
—	E30-1638-05	PC Cord Ass'y (ACSY)	☆
—	F05-2034-05	Fuse 20A	
—	F07-0826-05	Heat sink cover	☆
—	F09-0405-05	Fan	
—	G02-0505-05	Knob D spring × 3	
—	H01-2619-04	Carton (inside) (W)(K)	
—	H01-2620-04	Carton (inside) (T)	☆
—	H03-1706-04	Carton (outside) (K)	
—	H03-1707-04	Carton (outside) (W)	☆
—	H03-1708-04	Carton (outside) (T)	☆
—	H01-2574-04	Case cover	
—	H10-2509-02	Front packing fixture	☆
—	H10-2510-02	Rear packing fixture	
—	H12-0441-04	Accessory box	
—	H20-1405-03	Protective cover	
—	H21-0701-04	Protection sheet for VOX CONTROLS	
—	J02-0323-05	Foot × 4	
—	J02-0407-04	Tilt bracket	
—	J21-2504-04	Mounting stopper (SP)	☆
—	J31-0141-04	Spacer ring for mic	
—	J42-0038-04	Hole plug	
—	J42-0407-04	Knob bush × 2	
—	J61-0019-05	Vinyle tie × 10	
—	J61-0210-05	Vinyle tie	
—	J61-0401-05	Nylon cable tie × 4	
—	K21-0722-04	Main knob VFO	
—	K21-0723-04	Pointer knob large	
—	K21-0724-04	Knob (outside) × 3	
—	K23-0710-04	Knob (inside) × 3	
—	K23-0711-04	Pointer knob (small)	
—	K23-0712-04	VOX knob × 3	
—	K29-0709-04	Push knob (square) × 6	
—	N14-0508-04	Spanner Nut	
—	N14-0509-05	Wing nut	
—	N19-0607-04	Nylon panel washer	
—	N99-0303-05	Hex. head screw (VFO)	
—	T03-0027-15	Speaker	
—	T10-0301-05	Fan motor	☆
	B46-0058-00	Warranty Card (K)	

SWITCH (A) UNIT (X41-1140-00)

Ref. No.	Parts No.	Description	Re-marks
S1～3	S40-2404-05	Push switch SPJ222H	

SWITCH (B) UNIT (X41-1150-00)

Ref. No.	Parts No.	Description	Re-marks
R1	RD14CB2E681J	Carbon resistor 680Ω ±5% 1/4W	
D1	V11-0076-05	Diode 1S1555	
S1～3	S40-2405-05	Push switch SPJ222E	
C1	CK45F1H103Z	Ceramic 0.01μF +80%−20%	

PARTS LIST

RELAY UNIT (X41-1250-00)

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C1	CK45F1H103Z	Ceramic 0.01μF +80%−20%	
C2	CE04W1HR47	Electrolytic 0.47μF 50WV	
		RESISTOR	
R1,2	RD14BB2E○○○J	Carbon resistor ○○○Ω ±5% 1/4W	
		SEMICONDUCTOR/RELAY	
Q1	V03-1959-06-	Transistor 2SC1959 (Y)	
D1,D2	V11-0076-05	Diode 1S1555	
	S51-2408-05	Relay G2V2	

DC CABLE ASS'Y (E30-1638-05)

Ref. No.	Parts No.	Description	Re-marks
—	E30-1637-05	Cable	
—	F05-2034-05	Fuse (20A)	
—	J13-0404-05	Fuse holder	
—	J61-0201-05	Vinyle tie x 10	

RF UNIT (X-1260-01)

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C1	CC45RH1H101J	Ceramic 100pF ±5%	
C3	CQ09S1H102J	Styrene 1000pF ±5%	
C5	CC45RH1H221J	Ceramic 220pF ±5%	
C6	CC45RH1H151J	Ceramic 150pF ±5%	
C7	CC45RH1H221J	Ceramic 220pF ±5%	
C10	CC45RH1H820J	Ceramic 82pF ±5%	
C11	CC45RH1H390J	Ceramic 39pF ±5%	
C12	CC45RH1H101J	Ceramic 100pF ±5%	
C15	CC45RH1H100D	Ceramic 10pF ±0.5pF	
C16	CC45RH1H270J	Ceramic 27pF ±5%	
C17	CC45RH1H330J	Ceramic 33pF ±5%	
C20	CC45RH1H330J	Ceramic 33pF ±5%	
C21	CC45RH1H100D	Ceramic 10pF ±0.5pF	
C22	CC45RH1H050C	Ceramic 5pF ±0.25pF	
C25	CC45RH1H030C	Ceramic 3pF ±0.25pF	
C26	CC45RH1H070C	Ceramic 7pF ±0.25pF	
C27	CC45RH1H270J	Ceramic 27pF ±5%	
C31,32	C90-0262-05	Ceramic 0.047μF 25WV	
C33	CC45SL1H070C	Ceramic 7pF ±0.25pF	
C35	C90-0262-05	Ceramic 0.047μF 25WV	
C37～39	C90-0262-05	Ceramic 0.047μF 25WV	
C40	CC45SL1H220J	Ceramic 22pF ±0.5pF	
C41	C90-0262-05	Ceramic 0.047μF 25WV	
C43	CC45SL1H150J	Ceramic 15pF ±5%	
C44	CC45SL1H220J	Ceramic 22pF ±5%	
C45	CC45SL1H270J	Ceramic 27pF ±5%	
C46,47	C91-0455-05	Ceramic 0.01μF	
C49,50	C90-0262-05	Ceramic 0.047μF 25WV	
C56	C90-0262-05	Ceramic 0.047μF 25WV	
C58	C90-0262-05	Ceramic 0.047μF 25WV	
C61	CC45SL1H221J	Ceramic 220pF ±5%	
C63	CE04W1C100	Electrolytic 10μF 16WV	
C64	CE04W1C100	Ceramic 10μF 16WV	

Ref. No.	Parts No.	Description	Re-marks
C66	C91-0456-05	Ceramic 0.047μF 25WV	
C69	CE04W1H4R7	Electrolytic 4.7μF 50WV	
C74	CC45RH1H120J	Ceramic 12pF ±0.25pF	
C76	CC45RH1H101J	Ceramic 100pF ±5%	
C78	CC45SL1H050C	Ceramic 5pF ±0.25pF	
		RESISTOR	
R1～66	RD14CB2E○○○J	Carbon Resistor ○○○Ω ±5% 1/4W	
R22,32	NOT USED		
		SEMICONDUCTOR	
Q1	V09-1002-56	FET 3SK74(L)	
Q2	V03-1815-06	Transistor 2SC1815(Y)	
Q3～6	V09-1002-56	FET 3SK74(L)	
Q7,8	V03-1815-06	Transistor 2SC1815(Y)	
Q9	V03-2086-06	Transistor 2SC2086	
Q10	V01-1015-06	Transistor 2SA1015(Y)	
D1	V11-0370-05	Diode 1S1587	
D2	V11-0414-05	Diode 1S2588	
D3	V11-0370-05	Diode 1S1587	
D4	V11-0414-05	Diode 1S2588	
D5	V11-0370-05	Diode 1S1587	
D6	V11-0076-05	Diode 1S1555	
D7	V11-0051-05	Diode 1N60	
D8	V11-3172-76	Diode 1S1585	
		COIL/INDUCTOR/TRANSFORMER	
L1	L34-0559-05	Trap coil 8.83 MHz	
L2	L34-0558-05	Trap coil 8.83 MHz	
L3	L34-0698-05	BPF coil 3.5 MHz	
L4	L34-0699-05	BPF coil 3.5 MHz	
L5	L34-0698-05	BPF coil 3.5 MHz	
L6	L34-0700-05	BPF coil 7 MHz	
L7	L34-0701-05	BPF coil 7 MHz	
L8	L34-0700-05	BPF coil 7 MHz	
L9	L34-0702-05	BPF coil 14 MHz, WWV	
L10	L34-0703-05	BPF coil 14 MHz, WWV	
L11	L34-0702-05	BPF coil 14 MHz, WWV	
L12	L34-0704-05	BPF coil 21 MHz	
L13	L34-0705-15	BPF coil 21 MHz	
L14	L34-0706-05	BPF coil 21 MHz	
L15	L34-0707-05	BPF coil 28 MHz	
L16	L34-0737-05	BPF coil 28 MHz	
L17	L34-0738-05	BPF coil 28 MHz	
L18,19	L40-1021-03	Ferri inductor 1 mH	
L20	L40-1011-03	Ferri inductor 100μH	
L21	L40-1592-02	Ferri inductor 1.5μH	
L22,23	L40-4711-03	Ferri inductor 470 μH	
L24	L40-4782-02	Ferri inductor 0.47μH	
L25～27	L40-4711-03	Ferri inductor 470μH	
L28,29	L40-1021-03	Ferri inductor 1 mH	
L30,31	L40-1011-03	Ferri inductor 100 μH	
L32	L40-4791-02	Ferri inductor 4.7μH	
L33	L33-0032-05	Choke coil 3 μH	
L34	L40-1011-03	Ferri inductor 100 μH	
L35	L34-0559-05	Trap coil 8.83 MHz	
T1	L34-0696-35	Input coil ANT	
T2	L19-0303-05	Wide range transformer	
T3,4	L34-0697-05	Output coil	
T5	L19-0303-05	Wide band transformer	
T6	L19-0302-05	Wide band transformer P.DRV	
		MISCELLANEOUS	
—	S29-3404-15	Rotary wafer ass'y	

PARTS LIST

IF UNIT (X48-1210-01)

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C1	CC45SL1H050C	Ceramic 5pF ±0.25pF	
C3.4	CC45SL1H470J	Ceramic 47pF ±5%	
C6	CE04W1C100	Electrolytic 10μF 16WV	
C22	CC45SL1H470J	Ceramic 47pF ±5%	
C23	CC45SL1H150J	Ceramic 15pF ±5%	
C28	CC45SL1H070D	Ceramic 7pF ±0.5pF	
C34	CC45SH1H100D	Ceramic 10pF ±0.5pF	
C35	CC45SH1H470J	Ceramic 47pF ±5%	
C38	CC45SL1H470J	Ceramic 47pF ±5%	
C40	CE04W1H010	Electrolytic 1μF 50WV	
C47	CE04W1H010	Electrolytic 1μF 50WV	
C49	CC45SL1H030C	Ceramic 3pF ±0.25pF	
C56	CC34SL1H470K	Ceramic 470pF ±10%	
		RESISTORS	
R1～67	RD14CB2E○○○J	Carbon resistor ○○○Ω ±5% 1/4W	
		SEMICONDUCTOR	
Q1～3	V09-1002-56	FET 3SK74(L)	
Q4	V09-0012-05	FET 2SK19(GR)	
Q5	V01-1015-06	Transistor 2SA1015(Y)	
Q6.7	V03-1815-06	Transistor 2SC1815(Y)	
Q8	V09-0012-05	FET 2SK19(GR)	
Q9～11	V03-0079-05	Transistor 2SC460(B)	
Q12,13	V03-1815-06	Transistor 2SC1815(Y)	
D1～4	V11-0370-05	Diode 1S1587	
D5	V11-4160-66	Diode 1S1007	
D6	V11-0370-05	Diode 1S1587	
D7	V11-4160-66	Diode 1S1007	
D8	V11-0370-05	Diode 1S1587	
D9,10	V11-0076-05	Diode 1S1555	
D11,12	V11-0051-05	Diode 1N60	
D13	V11-0076-05	Diode 1S1555	
D14,15	V11-0051-06	Diode 1N60	
D16	V21-0004-05	Varistor MV13	
D17～32	V11-0076-05	Diode 1S1555	
		POTENTIOMETER	
VR1	R12-3045-05	10kΩ (B)	
VR2	R12-6401-05	470kΩ (B)	
		INDUCTOR/COIL	
L1～5	L40-1511-03	Ferri-inductor 150μF	☆
T1.2	L34-0708-05	Tuning coil	
T3	L34-0537-05	Tuning coil	
T4	L34-0538-05	Tuning coil	
T5,6	L34-0535-05	Tuning coil	
T7	L34-0536-05	Tuning coil	
T8	L34-0535-05	Tuning coil	
T9	L34-0536-05	Tuning coil	
		MISCELLANEOUS	
XF1	L71-0208-05	Cristal filter 4 element, monolitic	☆
CF1,2	L72-0310-05	Ceramic filter for NB	☆
—	E23-0046-04	Terminal (Square)	
—	S51-4401-05	Relay LZN-4	

AF·GEN UNIT (X49-1110-00)

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C1	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C3	CQ92M1H333K	Mylar 0.033μF ±10%	
C4	CE04W1HR47	Electrolytic 0.47μF 50WV	
C5	CE04W1A221	Electrolytic 220μF 10WV	
C7,8	CE04W1C100	Electrolytic 10μF 16WV	
C9	CQ92M1H104K	Mylar 0.1μF ±10%	
C10,11	CE04W1C102Q	Electrolytic 1000μF 16WV	
C12	CQ92M1H104K	Mylar 0.1μF ±10%	
C13	CE04W1C470	Electrolytic 47μF 16WV	
C14	CQ92M1H104K	Mylar 0.1μF ±10%	
C16	CE04W1C470	Electrolytic 47μF 16WV	
C17	CE04W1H010	Electrolytic 1μF 50WV	
C18	CQ92M1H223K	Mylar 0.022μF ±10%	
C19	CE04W1C100	Electrolytic 10μF 16WV	
C20	VACANT		
C21,22	CE04W1C470	Electrolytic 47μF 16WV	
C23	CQ92M1H104K	Mylar 0.1μF ±10%	
C24	CE04W1C221	Electrolytic 220μF 16WV	
C30～33	CC45CH1H220J	Ceramic 22pF ±5%	
C37	CC45SL1H151J	Ceramic 150pF ±5%	
C38	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C39	CC45SL1H180J	Ceramic 18pF ±5%	
C41,42	CC45SL1H101J	Ceramic 100pF ±5%	
C43	CE04W1H010	Electrolytic 1μF 50WV	
C44	CE04W1A221	Electrolytic 220μF 10WV	
C45	CE04W1E4R7	Electrolytic 4.7μF 25WV	
C46	CE04W1H010	Electrolytic 1μF 50WV	
C47	CQ92M1H473K	Mylar 0.047μF ±10%	
C48,49	CE04W1E4R7	Electrolytic 4.7μF 25WV	
C50	CE04W1H010	Electrolytic 1μF 50WV	
C51	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C52	CE04W1H010	Electrolytic 1μF 50WV	
C55	CC45UJ1H220J	Ceramic 22pF ±5%	
C56	CC45SL1H101J	Ceramic 100pF ±5%	
C59	CC45CH1H050C	Ceramic 5pF ±0.25pF	
C64	CC45SL1H470J	Ceramic 47pF ±5%	
C66	CC45SL1H470J	Ceramic 47pF ±5%	
C67	CE04W1C100	Electrolytic 10μF 16WV	
C68	CE04W1H010	Electrolytic 1μF 50WV	
C69,70	CQ92M1H123K	Mylar 0.012μF ±10%	
C71	CQ921H104K	Mylar 0.1μF ±10%	
C72,73	CQ92M1H123K	Mylar 0.012μF ±10%	
C74	CE04W1H010	Electrolytic 1μF 50WV	
C75	CE04W1A221	Electrolytic 220μF 10WV	
C76,77	CE04W1A470	Electrolytic 47μF 10WV	
C78	CQ92M1H223K	Mylar 0.022μF ±10%	
C79	CE04W1H3R3	Electrolytic 3.3μF 50WV	
C80	CE04W1H010	Electrolytic 1μF 50WV	
C81	CQ92M1H473K	Mylar 0.047μF ±10%	
C83	CQ92M1H102K	Mylar 1000pF ±10%	
C84	CQ92M1H473K	Mylar 0.047μF ±10%	
C85,86	CE04W1E4R7	Electrolytic 4.7μF 25WV	
C86	CE04W1E3R3	Electrolytic 3.3μF 25WV	
C89	CC45SL1H101J	Ceramic 100pF ±5%	
C90	CE04W1C220	Electrolytic 22μF 16WV	
		RESISTOR	
R1～113	RD14CB2E○○○J RD14BB2E○○○J	Carbon ○○○Ω ±5% 1/4W	
R14	RS14GB3D8R2J	Metal film 8.2Ω ±5% 2W	
R36,80,93	NOT USED		

PARTS LIST

Ref. No.	Parts No.	Description		Re-marks
		SEMICONDUCTOR		
Q1	V03-2240-06	Transistor	2SC2240 (GR)	
Q2	V30-1029-36	IC	μPC14305H	
Q3	V01-0473-06	Transistor	2SA473 (Y)	
Q4～6	V03-1815-06	Transistor	2SC1815 (Y)	
Q7	V30-1045-06	IC	HA1366W	
Q8	V03-0079-05	Transistor	2SC460 (B)	
Q9	V03-1959-06	Transistor	2SC1959 (Y)	
Q10,11	V03-1815-06	Transistor	2SC1815 (Y)	
Q12	V09-0012-05	FET	2SK19 (GR)	
Q13	V03-0079-05	Transistor	2SC460 (B)	
Q14	V03-1815-06	Transistor	2SC1815 (Y)	
Q15	V01-1015-06	Transistor	2SA1015 (Y)	
Q16,17	V03-1815-06	Transistor	2SC1815 (Y)	
Q18	V03-2240-06	Transistor	2SC2240 (GR)	
Q19,20	V03-1815-06	Transistor	2SC1815 (Y)	
Q21	V01-1015-06	Transistor	2SA1015 (Y)	
Q22	V01-1815-16	Transistor	2SC1815 (GR)	
Q22,23	V03-1815-06	Transistor	2SC1815 (Y)	
Q24	V01-0032-05	Transistor	2SA562 (Y)	
Q25	V03-1815-06	Transistor	2SC1815 (Y)	
D～4	V11-0051-05	Diode	1N60	
D5	V11-0243-05	Zener diode	WZ-061	
D6～9	V11-0414-05	Diode	1S2588	
D10	NOT USED			
D11～14	V11-0051-05	Diode	1N60	
D15	V11-0370-05	Diode	1S1587	
D16	VACANT			
D17～22	V11-0076-05	Diode	1S1555	
D23,24	V11-0051-05	Diode	1N60	
D25	V11-0076-05	Diode	1S1555	
D26	V11-0051-05	Diode	1N60	
D27,28	V11-0076-05	Diode	1S1555	
		POTENTIOMETER		
VR1	R12-3025-05	10kΩ (B)	RIT	
VR2	R12-4016-05	50kΩ	RF	
VR3	R12-0042-05	50Ω (B)	9V	
VR4	R12-4016-05	50kΩ	SIDE TONE	
VR5	R12-0401-05	100Ω	BM	
VR6	R12-0405-05	330Ω (B)	ANTI VOX	
VR7	R12-3408-05	47kΩ	VOX GAIN	
VR8	R12-5402-05	220kΩ	DELAY	
		TRIMMER/COIL/INDUCTOR		
TC1～6	C05-0030-15	Ceramic trimmer	20pF	
L1	L40-1021-03	Ferri-inductor	1 mH	
L2,3	L40-1511-03	Ferri-inductor	150 μH	
L4	L40-4771-03	Ferri-inductor	470 μH	
L5	L40-3392-03	Ferri-inductor	3.3 μH	
L6,7	L40-1511-03	Ferri-inductor	150 μH	
L8	L40-1021-03	Ferri-inductor	1 mH	
T1	L15-0016-05	Filter choke		
T2	L34-0567-05	Tuning coil		
		MISCELLANEOUS		
—	E18-0401-05	Crystal socket 4P		
—	F20-0078-05	Insulating mica		
—	F29-0014-05	Shoulder washer		

PLL UNIT (X50-1490-00)

Ref. No.	Parts No.	Description			Re-marks
		CAPACITOR			
C1	CC45TH1H220J	Ceramic	22pF	±5%	
C2	CC45TH1H030C	Ceramic	3pF	±0.25pF	
C3	CC45TH1H220J	Ceramic	22pF	±5%	
C4	CE0W1A470	Electrolytic	47μF	10WV	
C5	CC45UJ1H560J	Ceramic	56pF	±5%	
C6	CC45UJ1H270J	Ceramic	27pF	±5%	
C9	CC45TH1H150J	Ceramic	15pF	±5%	
C10	CC45TH1H030C	Ceramic	3pF	±0.25pF	
C11	CC45TH1H220J	Ceramic	22pF	±5%	
C12	CE04W1A470	Electrolytic	47μF	10WV	
C13	CC45TH1H330J	Ceramic	33pF	±5%	
C14	CC45TH1H470J	Ceramic	47pF	±5%	
C17	CC45TH1H270J	Ceramic	27pF	±5%	
C18	CC45UJ1H220J	Ceramic	22pF	±5%	
C19	CE04W1A470	Electrolytic	47μF	10WV	
C20	CC45UJ1H101J	Ceramic	100pF	±5%	
C21	CC45UJ1H220J	Ceramic	22pF	±5%	
C24	CE04W1C100	Electrolytic	10μF	16WV	
C25	CC45TH1H270J	Ceramic	27pF	±5%	
C26	CC45TH1H150J	Ceramic	15pF	±5%	
C27	CC45TH1H220J	Ceramic	22pF	±5%	
C28	CE04W1A470	Electrolytic	47μF	10WV	
C29,30	CC45UJ1H560J	Ceramic	56pF	±5%	
C33	CC45TH1H270J	Ceramic	27pF	±5%	
C34	CC45TH1H100D	Ceramic	10pF	±0.5pF	
C35	CC45TH1H220J	Ceramic	22pF	±5%	
C36	CE04W1A470	Electrolytic	47μF	10WV	
C37	CC45RH1H390J	Ceramic	39pF	±5%	
C38	CC45SH1H560J	Ceramic	56pF	±5%	
C40	CC45CH1H100D	Ceramic	10pF	±0.5pF	
C41	CC45CH1H020C	Ceramic	2pF	±0.25pF	
C43,44	C90-0262-05	Ceramic	0.047μF	25WV	
C45	CC45SL1H151J	Ceramic	150μF	±5%	
C47	CC45SL1H271J	Ceramic	270pF	±5%	
C48	CC45SL1H121J	Ceramic	120pF	±5%	
C50,51	CC45SL1H390J	Ceramic	39pF	±5%	
C53	CE04W1C100	Electrolytic	10μF	16WV	
C54,55	C90-0262-05	Ceramic	0.047μF	25WV	
C57,58	CC45SL1H221J	Ceramic	220pF	±5%	
C59	CQ92M1H122K	Mylar	1200pF	±10%	
C60	CC45SL1H390J	Ceramic	39pF	±5%	
C61,62	CC45SL1H820J	Ceramic	82pF	±5%	
C63	CC45SL1H390J	Ceramic	39pF	±5%	
C65	C90-0262-05	Ceramic	0.047μF	25WV	
C70	CC45SL1H120J	Ceramic	12pF	±5%	
C71	VACANT				
C73	CC45CH1H010C	Ceramic	1pF	±0.25pF	
C74	CC45CH1H050C	Ceramic	5pF	±0.25pF	
C76	CC45SL1H271J	Ceramic	270pF	±5%	
C77	C90-0262-05	Ceramic	0.047μF	25WV	
C78	CE04W1A101	Electrolytic	100μF	10WV	
C79	C90-0262-05	Ceramic	0.047μF	25WV	
C80	CQ92M1H104K	Mylar	0.1μF	±10%	
C81	CQ92M1H102K	Mylar	1000pF	±10%	
C82,83	C90-0262-05	Ceramic	0.047μF	25WV	
C84	CE04W0J101	Electrolytic	100μF	6.3WV	
C89	CE04W1A470	Electrolytic	47μF	10WV	
C90	VACANT				
C95	CC45RH1H330J	Ceramic	33pF	±5%	

PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
C96	CC45RH1H150D	Ceramic 15pF ±0.5pF	
C97	CC45RH1H330J	Ceramic 33pF ±5%	
C100	CC45RH1H150D	Ceramic 15pF ±0.5%	
C101	CC45RH1H040C	Ceramic 4pF ±0.25pF	
C102	CC45RH1H150D	Ceramic 15pF ±0.5pF	
C106	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C109	CC45RH1H470J	Ceramic 47pF ±5%	
C110	CC45RH1H220J	Ceramic 22pF ±5%	
C112	CC45RH1H560J	Ceramic 56pF ±5%	
C113	CC45SL1H070D	Ceramic 7pF ±0.5pF	
C114	CC45RH1H390J	Ceramic 39pF ±5%	
C117	CC45SL1H470J	Ceramic 47pF ±5%	
C118	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C119	CC45RH1H470J	Ceramic 47pF ±5%	
C127	CC45RH1H070D	Ceramic 7pF ±0.5%	
R1～92	RD14CB2E○○○J RD14BB2E○○○J		
R77	NOT USED		
		SEMICONDUCTOR	
Q1,2	V03-0079-05	Transistor 2SC460 (B)	
Q3	V03-0368-05	Transistor 2SC784 (O)	
Q4,5	V03-0079-05	Transistor 2SC460 (B)	
Q6	V03-0368-05	Transistor 2SC784 (O)	
Q7,8	V03-1959-06	Transistor 2SC1959 (Y)	
Q9	V03-1815-06	Transistor 2SC1815 (Y)	
Q10,11	V03-0079-05	Transistor 2SC460 (B)	
Q12	V30-1048-06	IC SN16913P	
Q13,14	V03-0079-05	Transistor 2SC460 (B)	
Q15	V30-1046-06	IC HD74LS00P	
Q16	V30-1037-06	IC HD74LS163N	
Q17～19	V03-1775-06	Transistor 2SC1775 (E)	
Q20	V30-0173-05	IC MC4044P	
Q21	V03-1815-06	Transistor 2SC1815 (Y)	
Q22	V03-0079-05	Transistor 2SC460 (B)	
Q23	V09-0079-05	FET 3SK40 (L)	
Q24,25	V03-0079-05	Transistor 2SC460 (B)	
Q26	V30-1048-06	IC SN16913P	
Q27	V03-1815-06	Transistor 2SC1815 (Y)	
D1～4	V11-0076-05	Diode 1S1555	
D5	V11-4161-36	Diode 1SV53A	
D6	V11-0370-05	Diode 1S1587	
D7	V11-4161-36	Varicap 1SV53A	
D8	V11-0370-05	Diode 1S1587	
D9	V11-4161-36	Varicap 1SV53A	
D10	V11-0414-05	Diode 1S2588	
D11	V11-4161-36	Varicap 1SV53A	
D12	V11-0370-05	Diode 1S1587	
D13	V11-4161-36	Varicap 1SV53A	
D14	V11-0370-05	Diode 1S1587	
D15	V11-0370-05	Diode 1S1587	
D16	NOT USED		
D17～21	V11-0370-05	Diode 1S1587	
D22,23	V11-0076-05	Diode 1S1555	
D24～27	V11-0370-05	Diode 1S1587	
		POTENTIOMETER	
VR1	R12-5014-05	100kΩ Spurious	
		INDUCTOR/COIL	
L1～8	L40-1511-03	Ferri-inductor 150μH	
L9	L40-4701-03	Ferri-inductor 47μH	
L10	L40-1592-02	Ferri-inductor 1.5μH	
L11,12	L40-1092-02	Ferri-inductor 1μH	

Ref. No.	Parts No.	Description	Re-marks
L13	L40-1292-02	Ferri-inductor 1.2μH	
L14	L40-2701-03	Ferri-inductor 27μH	
L15	L40-4711-03	Ferri-inductor 470μH	
L16	L40-1511-03	Ferri-inductor 150μH	
L17	L40-1011-03	Ferri-inductor 100μH	
L18	L40-1511-03	Ferri-inductor 150μH	
L19～21	L40-2701-03	Ferri-inductor 27μH	
L22～24	L40-1511-03	Ferri-inductor 150μH	
L25	L40-1001-03	Ferri-inductor 10μH	
L26	L40-4711-03	Ferri-inductor 470μH	
L27	L40-1511-03	Ferri-inductor 150μH	
L28	L40-1001-03	Ferri-inductor 10μH	
L29,30	L40-1511-03	Ferri-inductor 150μH	
T1	L32-0199-05	OSC coil 14 MHz	
T2	L32-0197-05	OSC coil 21 MHz	
T3	L32-0198-05	OSC coil 28 MHz	
T4	L32-0195-05	OSC coil 7 MHz	
T5	L32-0193-05	OSC coil 3.5 MHz	
T6	L34-0529-05	Trap coil 8.83 MHz	
T7	L34-0714-05	Tuning coil	
T8	L34-0715-05	Tuning coil	
T9	L34-0716-05	Tuning coil	
T10	L34-0717-05	Tuning coil	
T11	L34-0718-05	Tuning coil	
T12	L34-0757-05	Tuning coil	
T13	L34-0711-05	Tuning coil	
T14	L34-0709-05	Tuning coil 10 MHz	
T15	L34-0710-05	Tuning coil 20 MHz	
T17	L34-0712-05	Tuning coil	
T18	L34-0713-05	Tuning coil	
		MISCELLANEOUS	
—	E23-0046-04	Terminal (square)	

CAR UNIT (X50-1500-00)

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C2	CC45UJ1H220J	Ceramic 22pF ±5%	
C3	CC45UJ1H270J	Ceramic 27pF ±5%	
C4	CC45UJ1H220J	Ceramic 22pF ±5%	
C7,8	VACANT		
C9	CS15E1VR22M	Tantalum 0.22μF 35WV	
C13	CC45SL1H101J	Ceramic 100pF ±5%	
C14	CC45CH1H020C	Ceramic 2pF ±0.25pF	
C15	CC45CH1H330J	Ceramic 33pF ±5%	
C16	C90-0262-05	Ceramic 0.047μF 25WV	
		RESISTOR	
R1～21	RD14CB2E○○○J	Carbon resistor ○○○Ω ±5% 1/4W	
		SEMICONDUCTOR	
Q1,2	V03-0079-05	Transistor 2SC460 (B)	
Q3	V03-1959-06	Transistor 2SC1959 (Y)	
D1,2	V11-0076-05	Diode 1S1555	
D3	V11-4161-36	Varicup 1SV53A	
D4～6	V11-0076-05	Diode 1S1555	
		POTENTIOMETER	
VR1,2	R12-1012-05	1kΩ (B)	

PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
	MISCELLANEOUS		
TC1,2	C05-0056-05	Ceramic trimmer 30pF	
X1	L77-0485-05	Quartz crystal 8831.5 kHz	
X2	L77-0486-05	Quartz crystal 8828.5 kHz	
L1~3	L40-1511-03	Ferri-inductor 150μH	
L4	L33-0266-05	Choke coil 28μH	
L5~7	L40-1511-03	Ferri-inductor 150μH	
T1	L32-0201-05	OSC coil	

FILTER UNIT (X51-1200-00)

Ref. No.	Parts No.	Description	Re-marks
C1	CM93D2H821J	Mica 820pF ±5%	
C2,3	CM93D2H122J	Mica 1200pF ±5%	
C4	CM93D2H561J	Mica 560pF ±5%	
C5	CM93D2H331J	Mica 330pF ±5%	
C6	CM93D2H621J	Mica 620pF ±5%	
C7	CM93D2H331J	Mica 330pF ±5%	
C8	CM93D2H271J	Mica 160pF ±5%	
C9	CM93D2H331J	Mica 330pF ±5%	
C10	CM93D2H161J	Mica 160pF ±5%	
C11	CM93D2H121J	Mica 120pF ±5%	
C12	CM93D2H221J	Mica 220pF ±5%	
C13	CM93D2H121J	Mica 120pF ±5%	
C14	CM93D2H820J	Mica 82pF ±5%	
C15	CM93D2H161J	Mica 160pF ±5%	
C16	CM93D2H131J	Mica 130pF ±5%	
C17,18	NOT USED		
C20	CC45SL2H221J	Ceramic 220pF ±5%	
C21	CC45CH2H030J	Ceramic 3pF ±0.25 pF	
C22	CC45CH1H680J	Ceramic 68pF ±5%	
C24	C91-0456-05	Ceramic 0.047μF 25 WV	
C25	CE04W1HR47	Electrolytic 0.47μF 50WV	
C27	CE04W1H010	Electrolytic 1μF 50WV	
C28	CE04W1C100	Electrolytic 10μF 16WV	
C29	C91-0456-05	Ceramic 0.047μF 25WV	
C31,32	NOT USED		
C35	CE04W1C221	Electrolytic 220μF 16WV	
C36	C91-0456-05	Ceramic 0.047μF 25WV	
C38	NOT USED		
C41	C91-0456-05	Ceramic 0.047μF 25WV	
C42	CM93D2H101J	Mica 100pF ±5%	
R~33	RD14CB2E○○○J	Carbon resistor ○○○Ω ±5% 1/4W	
R6,7	NOT USED		
R23	RC05GF2H151J	Solid resistor 150Ω ±5% 1/2W	
R33	RD14BB2E820J	Carbon resistor 82Ω ±5% 1/4W	
Q1~5	V03-1815-06	Transistor 2SC1815 (Y)	
Q6	V01-0032-05	Transistor 2SA562 (Y)	
Q7,8,9	V03-1815-06	Transistor 2SC1815 (Y)	
Q10	V01-0473-06	Transistor 2SA473 (Y)	
D1,2	V11-0051-05	Diode 1N60	
D3	V11-4161-06	Zener diode WZ-044	
D4	V11-0076-05	Diode 1S1555	
D5	V11-0243-05	Zener diode WZ-061	
D6,7	V11-0076-05	Diode 1S1555	
D8	V11-0240-05	Zener diode WZ-090	
D9	V11-0076-05	Diode 1S1555	
D10	V11-0243-05	Zener diode WZ-061	
D11	V11-0240-05	Zener diode WZ-090	
D12	V11-0076-05	Diode 1S1555	
D13	V11-0240-05	Zener Diode WZ-090	
D14	V11-0076-05	Diode 1S1555	
VR1	R12-4016-05	Potentiometer 50kΩ (B)	
VR2	R12-3025-05	Potentiometer 10kΩ (B)	
VR3	R12-4016-05	Potentiometer 50kΩ (B)	
VR4	R12-0042-05	Potentiometer 500Ω (B)	
VR5	R12-1020-05	Potentiometer 1kΩ (B)	
TC1	C05-0043-05	Ceramic trimmer 20pF	
RL1	S51-4402-05	Relay	
L1~3	L34-0826-05	Filter coil (A)	☆
L4,5	L34-0827-05	Filter Coil (B)	☆
L6,7	L34-0828-05	Filter coil (C)	☆
L8,9	L34-0829-05	Filter coil (D)	☆
L10,11	L34-0830-05	Filter coil (E)	☆
L12	L40-1021-03	Ferri-inductor 1mH	
L13			
L14,15	L40-1021-03	Ferri-inductor 1mH	
L16,17	L40-1511-03	Ferri-inductor 150μH	
L18	L39-0406-05	Detector coil	☆
L19	L40-1511-03	Ferri-inductor 150μH	
—	E23-0046-04	Terminal (square) × 4	
—	E23-0401-05	Terminal (circle) × 24	
—	F20-0078-05	Insulating mica	
—	F29-0014-05	Shoulder washer	
—	J31-0502-04	Board stand (color) × 6	
—	J42-0404-05	Board stand (bush) × 6	

COUNTER UNIT (X54-1360-00)

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C1	CC45CH1H330J	Ceramic 33pF ±5%	
C2	CC45SL1H391J	Ceramic 390pF ±5%	
C3	CC45CH1H470J	Ceramic 47pF ±5%	
C4	C90-0262-05	Ceramic 0.047μF 25WV	
C5	CC45SL1H150J	Ceramic 15pF ±5%	
C6	CC45SL1H020C	Ceramic 2pF ±0.25pF	
C7	CC45SL1H100D	Ceramic 10pF ±0.5pF	
C10	C90-0262-05	Ceramic 0.047μF 25WV	
C11	CE04W0J101Q	Electrolytic 100μF 6.3WV	
C12	CC45SL1H101J	Ceramic 100pF ±5%	
C13	C90-0262-05	Ceramic 0.047μF 25WV	
C14	CC45SL1H390J	Ceramic 39pF ±5%	
C15	CC45SL1H330J	Ceramic 33pF ±5%	
C16	CC45SL1H101J	Ceramic 100pF ±5%	
C17	CC45SL1H221J	Ceramic 220pF ±5%	
C18	CC45SL1H220J	Ceramic 22pF ±5%	
C19	CC45SL1H050C	Ceramic 5pF ±0.25pF	
C20	C90-0262-05	Ceramic 0.047μF 25WV	
C21	CC45SL1H101J	Ceramic 100pF ±5%	
C22	CC45SL1H270J	Ceramic 27pF ±5%	
C23	CC45SL1H560J	Ceramic 56pF ±5%	

PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
C24	CC45SL1H270J	Ceramic 27pF ±5%	
C25	CC45SL1H470J	Ceramic 47pF ±5%	
C26	NOT USED		
C27,28	CC45SL1H470J	Ceramic 47pF ±5%	
C29	C90-0262-05	Ceramic 0.047μF 25WV	
C31	C90-0262-05	Ceramic 0.047μF 25WV	
C32	CC45SL1H121J	Ceramic 120pF ±5%	
C33	CC45SL1H271J	Ceramic 270pF ±5%	
C34	CC45SL1H121J	Ceramic 120pF ±5%	
C36	C90-0262-05	Ceramic 0.047μF 25WV	
C38～40	C90-0262-05	Ceramic 0.047μF 25WV	
C41	CE04W0J101Q	Electrolytic 100μF 6.3WV	
C44	CQ92M1H152K	Mylar 1500pF ±10%	
C45,56	C90-0262-05	Ceramic 0.047μF 25WV	
C47,48	CE04W0J221Q	Electrolytic 220μF 6.3WV	
C49	CE04W1V100Q	Electrolytic 10μF 35WV	
C51～53	CE04W1V100Q	Electrolytic 10μF 35WV	
C55～58	C90-0262-05	Ceramic 0.047μF 25WV	
		RESISTOR	
R1～57	RD14CB2E○○○J	Carbon resistor ○○○Ω ±5% 1/4W	
R13	NOT USED		
RB1	R90-0506-05	(47kΩ+47kΩ)×6	
RB2,3	R90-0521-05	47kΩ×7	
RB4,5	R90-0522-05	47kΩ×6	
		SEMICONDUCTOR	
Q1～5	V03-1815-06	Transistor 2SC1815 (Y)	
Q6	V03-0473-05	Transistor 2SC785 (O)	
Q7	V09-1002-46	FET 3SK73 (GR)	
Q8～10	V03-1815-06	Transistor 2SC1815 (Y)	
Q11,12	V03-1959-06	Transistor 2SC1959 (Y)	
Q13	V03-1815-06	Transistor 2SC1815 (Y)	
IC1	V30-1005-26	IC SN74LS90N	
IC2	V30-1040-06	IC TC5026BP	
IC3,4	V30-1039-06	IC TC4518BP	
IC5	V30-1050-06	IC TC4027BP	
IC6,7	V30-1030-06	IC TC4011BP	
IC8	V30-1055-06	IC TC5051BP	
IC9	V30-1051-06	IC TC4029BP	
IC10	V30-1052-06	IC TC4042BP	
IC11～13	V30-1049-06	IC TC4019BP	
IC14	V30-1009-26	IC TC4049BP	
IC15	V30-1054-06	IC TC5022BP	
IC16	V30-1057-06	IC TC5066BP	
IC18	V30-1053-06	IC TC5012BP	
IC19	V30-1056-06	IC TC5064BP	
D1	V11-0240-05	Zener diode WZ-090	
D2	VACANT		
D3～18	V11-0076-05	Diode 1S1555	
D19	V11-4160-86	Zener diode WZ-071	
D20	V11-4162-66	Zener diode XZ-060	
D21～24	V11-0076-05	Diode 1S1555	
D25	V21-0004-05	Varistor MV-13	
		MISCELLANEOUS	
—	V40-7760-05	Indicating tube 9-BT-12	☆
TC1	C05-0035-05	Ceramic trimmer 50pF	
L1,2	L40-4711-03	Ferri-inductor 470μH	
L3,4	L40-4701-03	Ferri-inductor 47μH	
L5	L40-4711-03	Ferri-inductor 470μH	
L6,7	L40-2711-03	Ferri-inductor 270μH	
L8	L40-4711-03	Ferri-inductor 470μH	
L9	L33-0616-05	Choke coil 43μH	☆

Ref. No.	Parts No.	Description	Re-marks
L10,11	L40-4711-03	Ferri-inductor 470μH	
L12,13	L40-1511-03	Ferri-inductor 150μH	
T1	L19-0305-05	Oscillator transformer	☆
X2	L77-0482-05	Quartz crystal 10 MHz	
—	E31-0430-15	Ribbon conductor	

FINAL UNIT (X56-1350-00)

Ref. No.	Parts No.	Description	Re-marks
C1	C91-0455-05	Ceramic 0.01μF 25WV	
C3	C91-0456-05	Ceramic 0.047μF 25WV	
C4	C91-0456-05	Ceramic 0.047μF 25WV	
C5	CK45B1H102K	Ceramic 0.001μF ±10%	
C6	C91-0455-05	Ceramic 0.01μF 25WV	
C7	NOT USED		
C10	CK45B1H102K	Ceramic 0.001μF ±10%	
C11	C91-0456-05	Ceramic 0.047μF 25WV	
C12	CE04W1E100	Electrolytic 10μF 25WV	
C13,14	C91-0456-05	Ceramic 0.047μF 25WV	
C15	CM93AD2H151J	Mica 150pF ±5%	
C16,17	CK45B1H102K	Ceramic 0.001μF ±10%	
C18,19	C91-0456-05	Ceramic 0.047μF 25WV	
C20	CE04W1E101	Electrolytic 100μF 25WV	
C21	C91-0456-05	Ceramic 0.047μF 25WV	
C22	NOT USED		
C23	CK45B1H102K	Ceramic 0.001μF ±10%	
C24	C91-0456-05	Ceramic 0.047μF 25WV	
C25	CE04W1E100	Electrolytic 10μF 25WV	
C26～29	CK45B1H222KMU	Ceramic 0.0022μF ±10%	
C30～32	NOT USED		
C33,34	C91-0448-05	Ceramic 0.68μF	
C35	C91-0456-05	Ceramic 0.047μF 25WV	
C36	CK45B1H102K	Ceramic 0.001μF ±10%	
C37	CE04W1H101Q	Electrolytic 100μF 50WV	
C38	C91-0456-05	Ceramic 0.047μF 25WV	
C39	CM93AD2H271J	Mica 270pF ±5%	
C40	CM93AD2H331J	Mica 330pF ±5%	
C41～43	C91-0455-05	Ceramic 0.01μF 25WV	
C44	CM93AD2H271J	Mica 270pF ±5%	
C45,46	CK45B1H222KNU	Ceramic 0.0022μF ±10%	
C47	CM93AD2H331J	Mica 330pF ±5%	
C48,49	CK45B1H222KMU	Ceramic 0.0022μF ±10%	
C50	CC45SL1H220J	Ceramic 22pF ±5%	
C51,52	C90-0455-05	Ceramic 0.01μF 25WV	
C53	CM93AD2H471T	Mica 470pF ±5%	
R1～27	RD14BB2E○○○J RD14CB2E○○○J	Carbon resistor ○○○Ω±5% 1/4W	
R3	RC5GF2H4R7J	Solid resistor 4.7Ω ±5% 1/2W	
R12,13	RC05GF2H101J	Solid resistor 100Ω ±5% 1/2W	
R14～17	RS14AB3A3R9J	Metal film 3.9Ω ±5% 1W	
R18～23	RC05CF2H5R6J	Solid resistor 5.6Ω ±5% 1/2W	
Q1	V03-2075-06	Transistor 2SC2075	
Q2,3	V03-2509-06	Transistor 2SC2509	
Q4,5	V03-2290-16	Transistor 2SC2290J	☆
Q6,7	V04-0046-05	Transistor 2SD235 (Y)	
D1	V22-0031-05	Varistor SV-03	
D2	V11-4363-36	Varistor SV-4A	
D3	V22-0031-05	Varistor SV-03	
D4,5	V11-0051-05	Diode 1N60	

PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
Th1.2	V11-3360-16	Thermistor 25D29	☆
Th3	V11-7762-16	Thermistor 31D26	
VR1.2	R12-0058-05	Potentiometer 470Ω (B)	
TM1	S59-1404-05		☆
TM2	S59-1403-05		☆
L1	L40-4701-03	Ferri-inductor 47μH	
L2	L33-0025-05	RFC	
L3,4	L33-0032-05	RFC	
L5.6	NOT USED		
L7	L33-0617-05	RFC	
L8	L33-0025-05	RFC	
L9	L33-0625-05	RFC	
L10～12	L40-1011-04	Ferri-inductor 100μH	
L13,14	L40-1021-04	Ferri-inductor 1mH	
T1	L19-0317-05	Wide band transformer	☆
T2	L19-0311-05	Input transformer	☆
T3	L19-0313-05	NF Transformer	☆
T4	L19-0312-05	Output transformer	☆
—	E04-0152-05	M type receptacle ANT	
—	E08-0271-05	DC socket	
—	E23-0043-04		
—	E23-0046-04	Terminal (square) × 4	
—	E23-0401-05	Terminal (circle) × 8	
—	F01-0735-05		
—	F20-0078-05	Insulating mica × 3	
—	F29-0014-05	Shoulder washer × 3	
—	J31-0503-05	Beads × 4	
—	J32-0730-04	Hex･boss	☆
—	N14-0509-05	Wing nut	

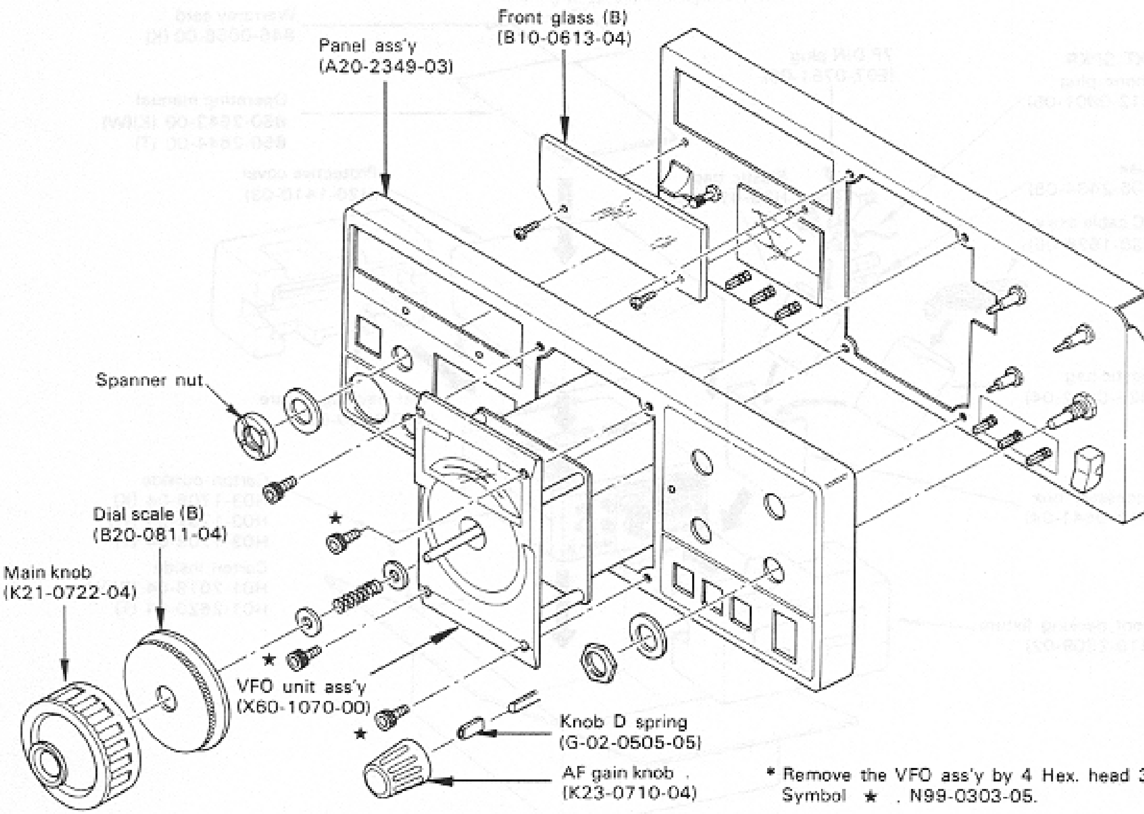
VFO ASS'Y UNIT (X60-1070-00)

Ref. No.	Parts No.	Description	Re-marks
		GENERAL	
—	B01-0615-05	Dial escutcheon	
—	B10-0612-04	Front glass (A)	
—	B20-0810-04	Dial scale (A)	
—	G01-0804-04	Coil spring	
—	K21-0722-04	Main knob	
—	N19-0608-04	Washer × 2	
—	X40-1130-00	VFO unit	

VFO UNIT (X40-1130-00)

Ref. No.	Parts No.	Description	Re-marks
		CAPACITOR	
C2	CC45SL1H390J	Ceramic 39pF ±5%	
C3	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C4	CC45SL1H390J	Ceramic 39pF ±5%	
C7	C90-0262-05	Ceramic 0.047μF 25WV	
C8	CC45CH1H020C	Ceramic 2pF ±0.25pF	
C10,11	C90-0262-05	Ceramic 0.047μF 25WV	
C12	CC45SG1H050C	Ceramic 5pF ±0.25pF	
C13	CC45LG1H470J	Ceramic 47pF ±5%	
C14	CC45LG1H220J	Ceramic 22pF ±5%	
C15,16	CC45LG1H151J	Ceramic 150pF ±5%	
C17	CC45SG1H150J	Ceramic 15pF ±5%	
C18	CC45RG1H120J	Ceramic 12pF ±5%	
C19	CC45LG1H151J	Ceramic 150pF ±5%	
C20	CC45CG1H121J	Ceramic 120pF ±5%	
		RESISTOR	
R～14	RD14CB2E○○○J	Carbon resistor ○○○Ω ±5% 1/4W	
		SEMICONDUCTOR	
Q1	V09-0020-05	FET 3SK22 (Y)	
Q2	V09-0011-05	FET 2SK19 (Y)	
Q3	V03-0079-05	Transistor 2SC460 (B)	
Q4	V03-1959-06	Transistor 2SC1959 (Y)	
D4	V11-0414-05	Diode 1S2588	
D5	V1104161-36	Diode 1SV53A	
		TRIMMER/VC	
TC1	C05-0305-05	Ceramic trimmer 12pF	
TC2	C05-0013-15	Ceramic trimmer 20pF	
—	C02-0010-05	Variable capacitor	
		INDUCTOR/COIL	
L1,2	L40-4711-03	Ferri-inductor 470μH	
L3	L40-1501-03	Ferri-inductor 15μH	
L5～7	L40-4711-03	Ferri-inductor 470μH	
L8	L33-0025-05	Choke coil 1μH	
L9	L32-0609-05	Oscillator coil B	
L10	L32-0608-05	Oscillator coil A	
		MISCELLANEOUS	
—	B42-1645-04	Indication tape	
—	D22-0405-04	Coupling	
—	D40-0604-05	Dial mechanism	
—	E13-0163-05	1P Pin jack	
—	E23-0046-04	Terminal (square) × 4	

EXPLODED VIEW/DISASSEMBLY



* Remove the VFO ass'y by 4 Hex. head 3 mm screws.
Symbol ★ . N99-0303-05.

Fig. 7 Front panel exploded view/removing the VFO ass'y

No.	Description	Parts No.	Remarks
1	Subpanel	A22-0714-13	
2	GND screw	N09-0256-05	
3	Rotary switch	S01-1410-05	MODE
4	Phone Jack	E11-0034-05	PHONE
5	4P Mic socket	E06-0451-05	MIC
6	Paddle switch	S44-2402-05	STBY
7	Switch unit (B)	X41-1150-00	
8	Meter	B31-0618-05	
9	Meter housing	F29-0404-05	
10	Potentiometer	R06-9402-05	MIC CAR
11	Potentiometer	R06-9402-05	RF, AF
12	Potentiometer	R06-9403-05	RIT IF SHIFT
13	Gear ass'y	D40-0603-05	
14	Seesaw switch	S36-2402-05	POWER
15	Switch unit (A)	X41-1140-00	
16	Screw	N30-2604-46	
17	Screw	N34-3004-46	

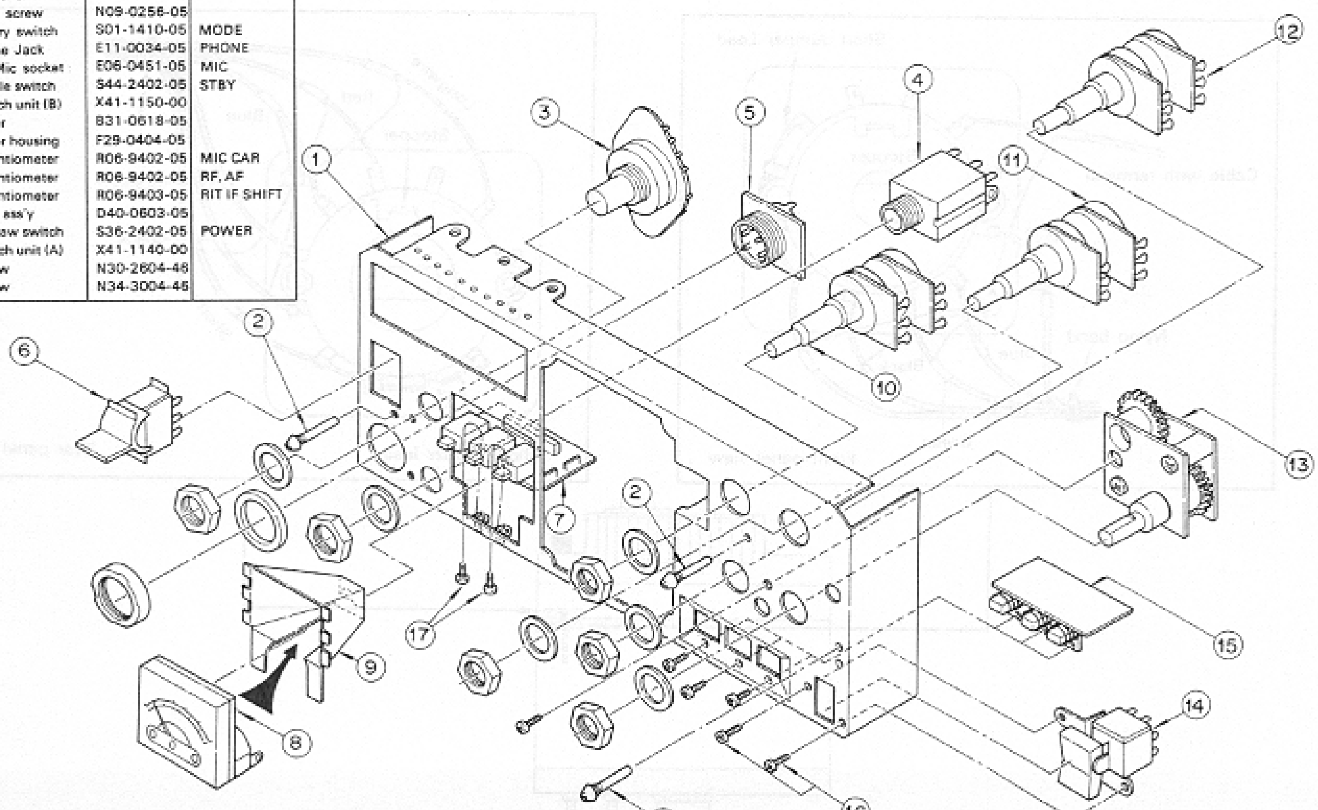
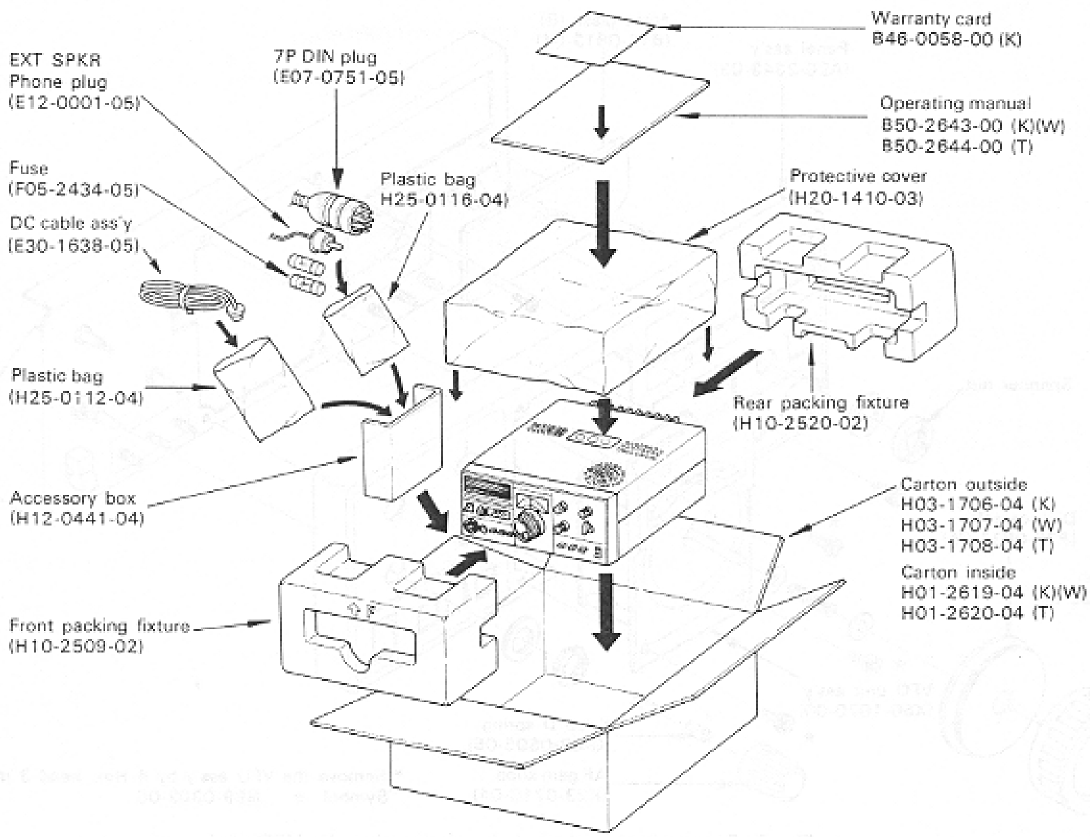


Fig. 8 Removing the subpanel

PACKING/DISASSEMBLY



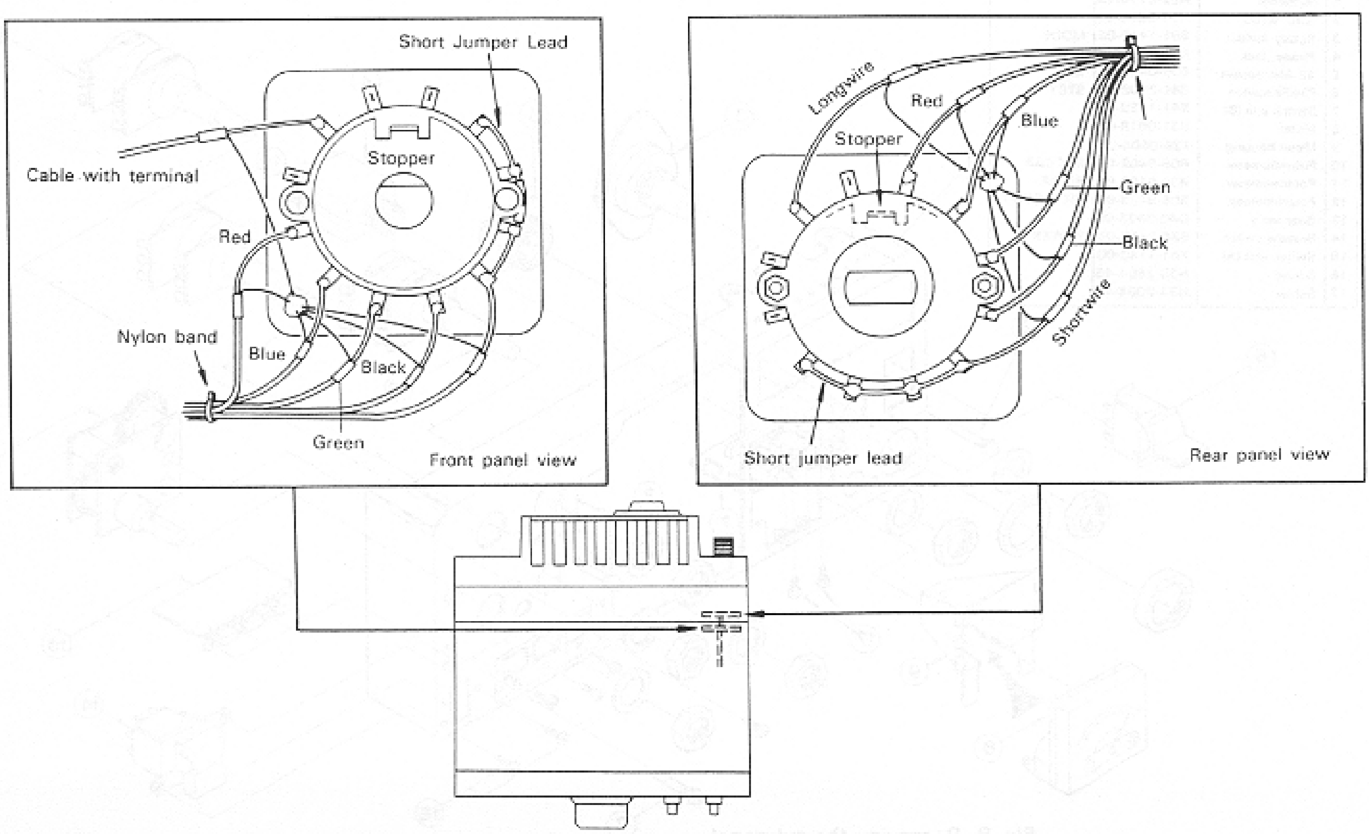


Fig. 6 BAND rotary switch (S01-2417-05) wiring.

DISASSEMBLY

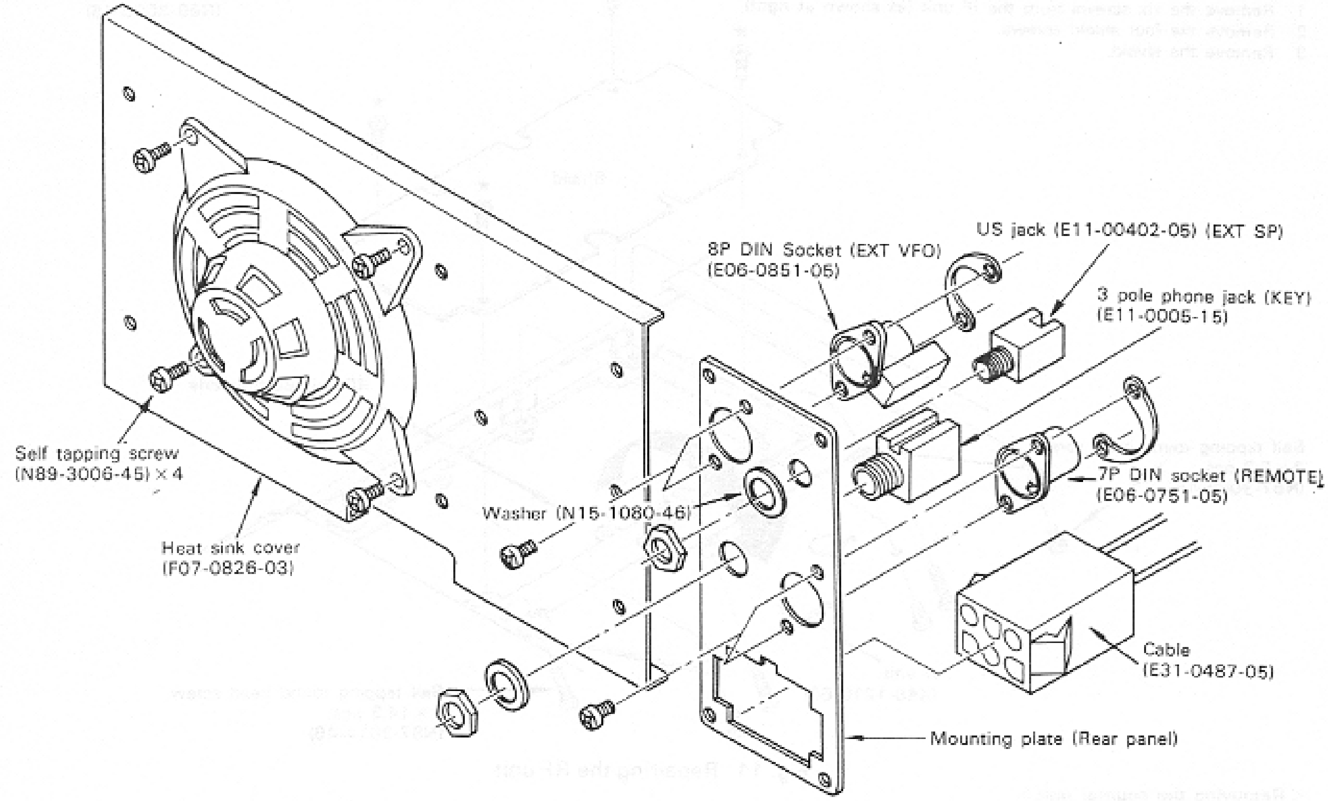
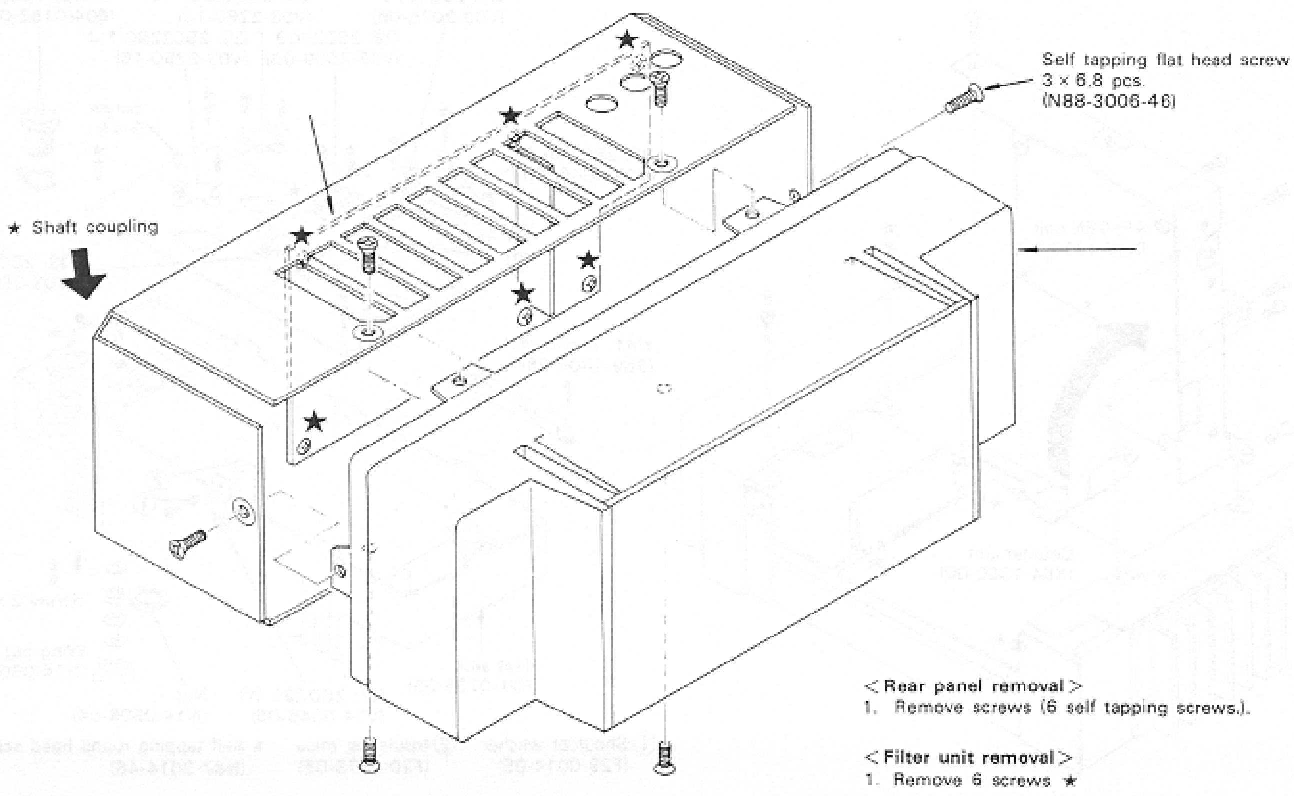


Fig. 9 Heat sink cover and Rear panel disassembly



< **Rear panel removal** >
1. Remove screws (6 self tapping screws.).

< **Filter unit removal** >
1. Remove 6 screws ★

Fig. 10 Rear panel/filter unit removal

DISASSEMBLY

<To gain access to the RF unit>
1. Remove the six screws from the IF unit (as shown at right).
2. Remove the four shield screws.
3. Remove the shield.

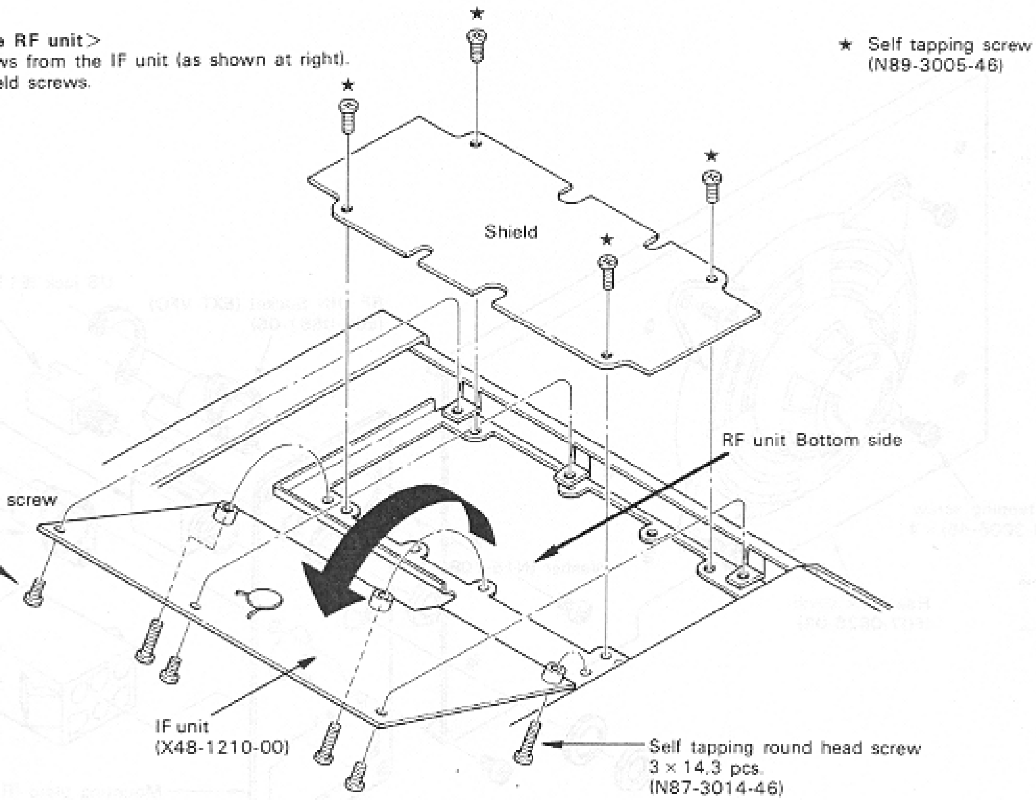


Fig. 11 Repairing the RF unit

<Removing the counter unit>
1. Remove the six screws from the AF•GEN unit (X49-1110-00) (as shown at bottom).
2. Remove screws (★) from the counter unit.

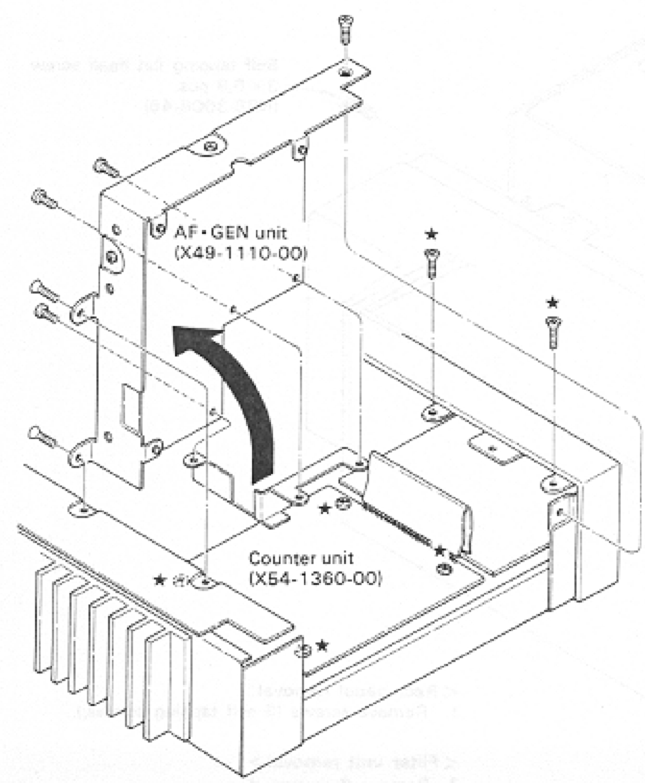


Fig. 12 Removing the counter unit

REMOVING THE FINAL UNIT

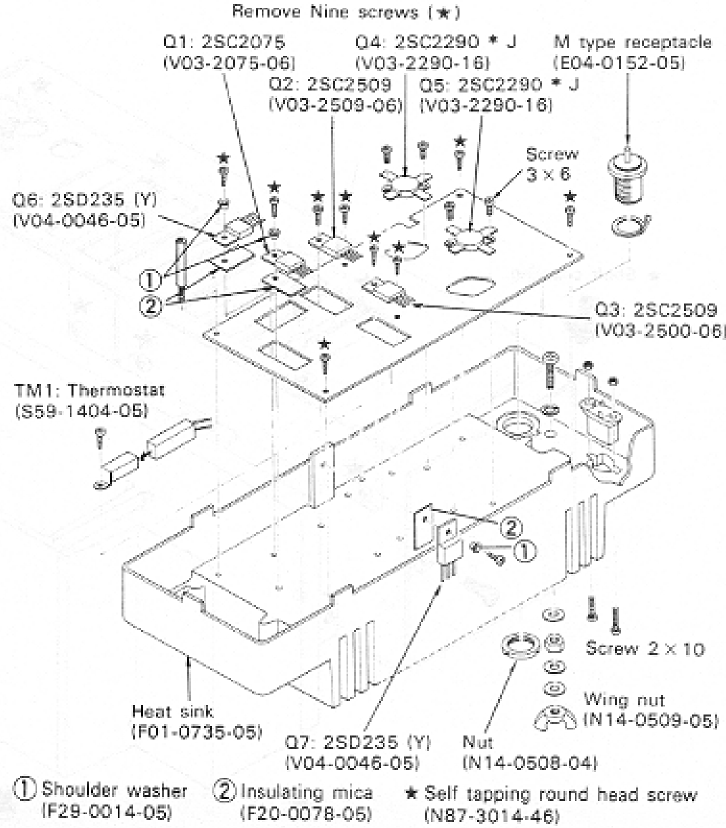
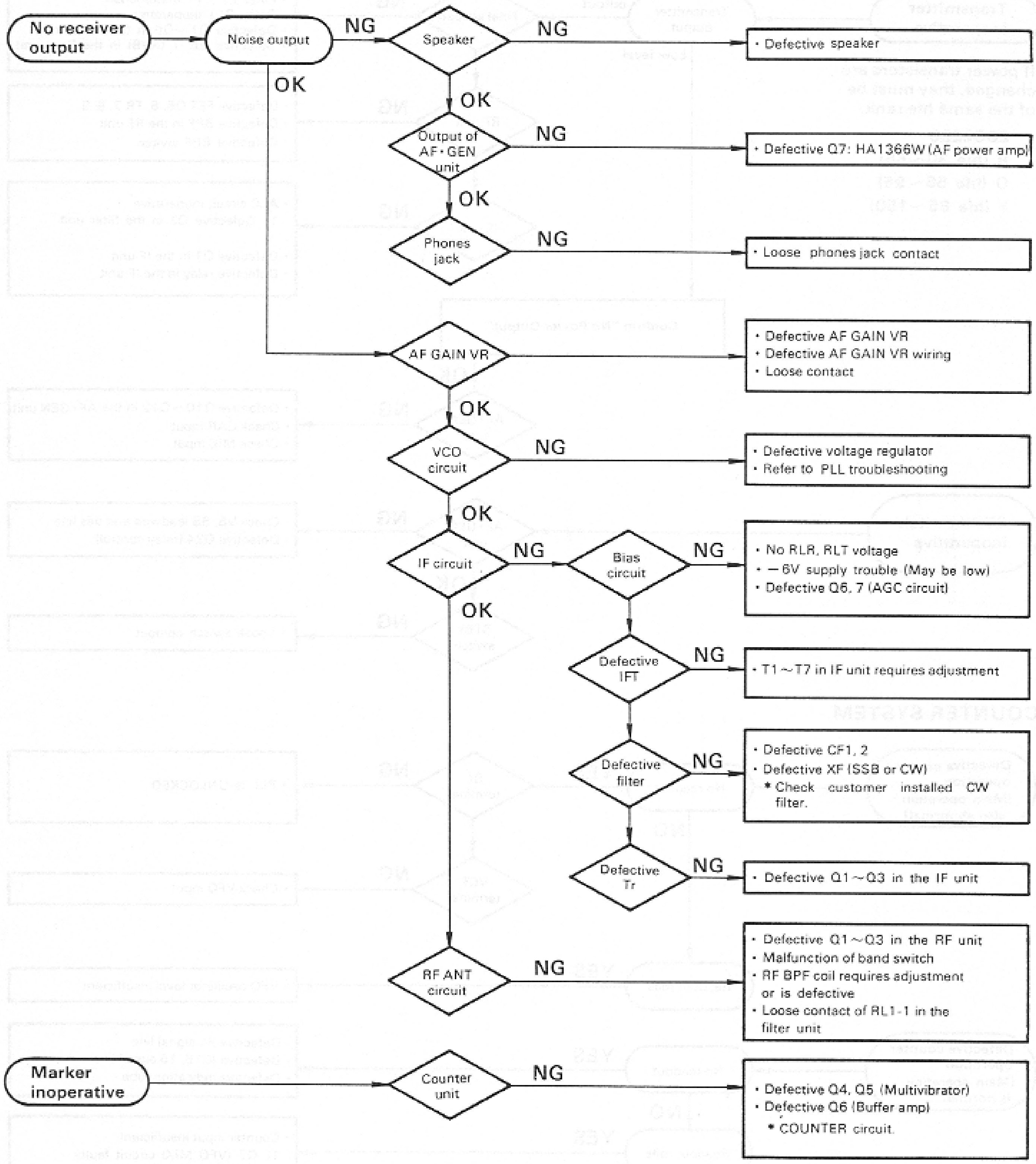


Fig. 13 Final unit disassembly

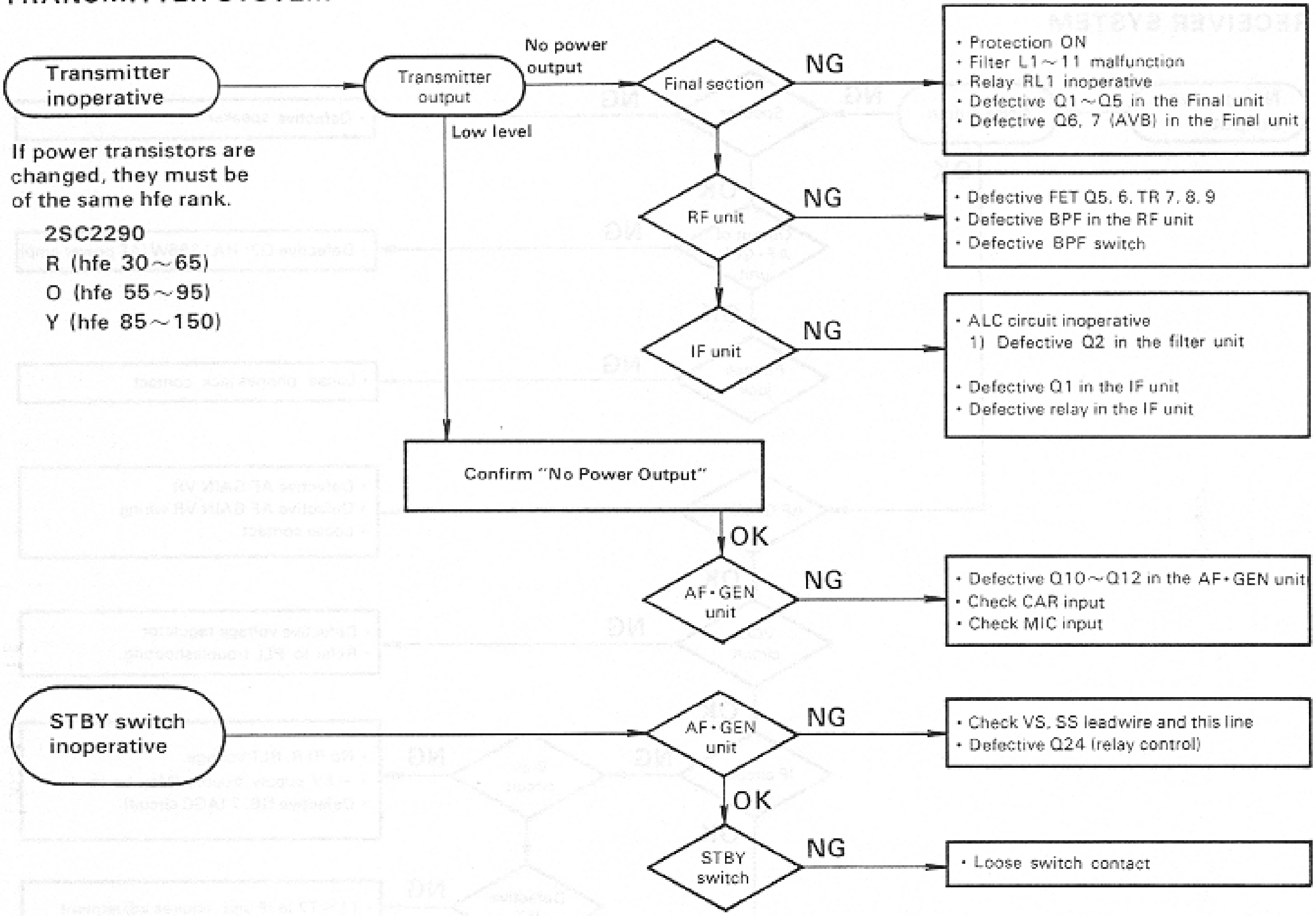
TROUBLE SHOOTING

RECEIVER SYSTEM



TROUBLE SHOOTING

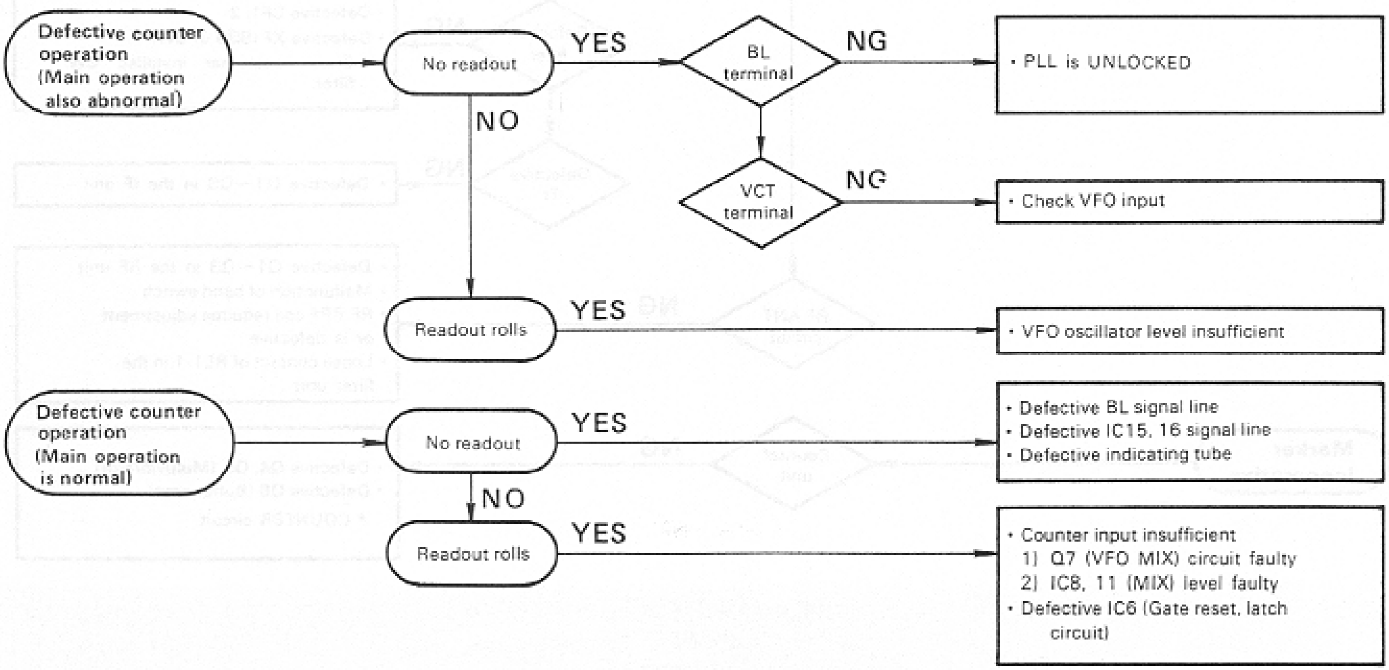
TRANSMITTER SYSTEM



If power transistors are changed, they must be of the same hfe rank.

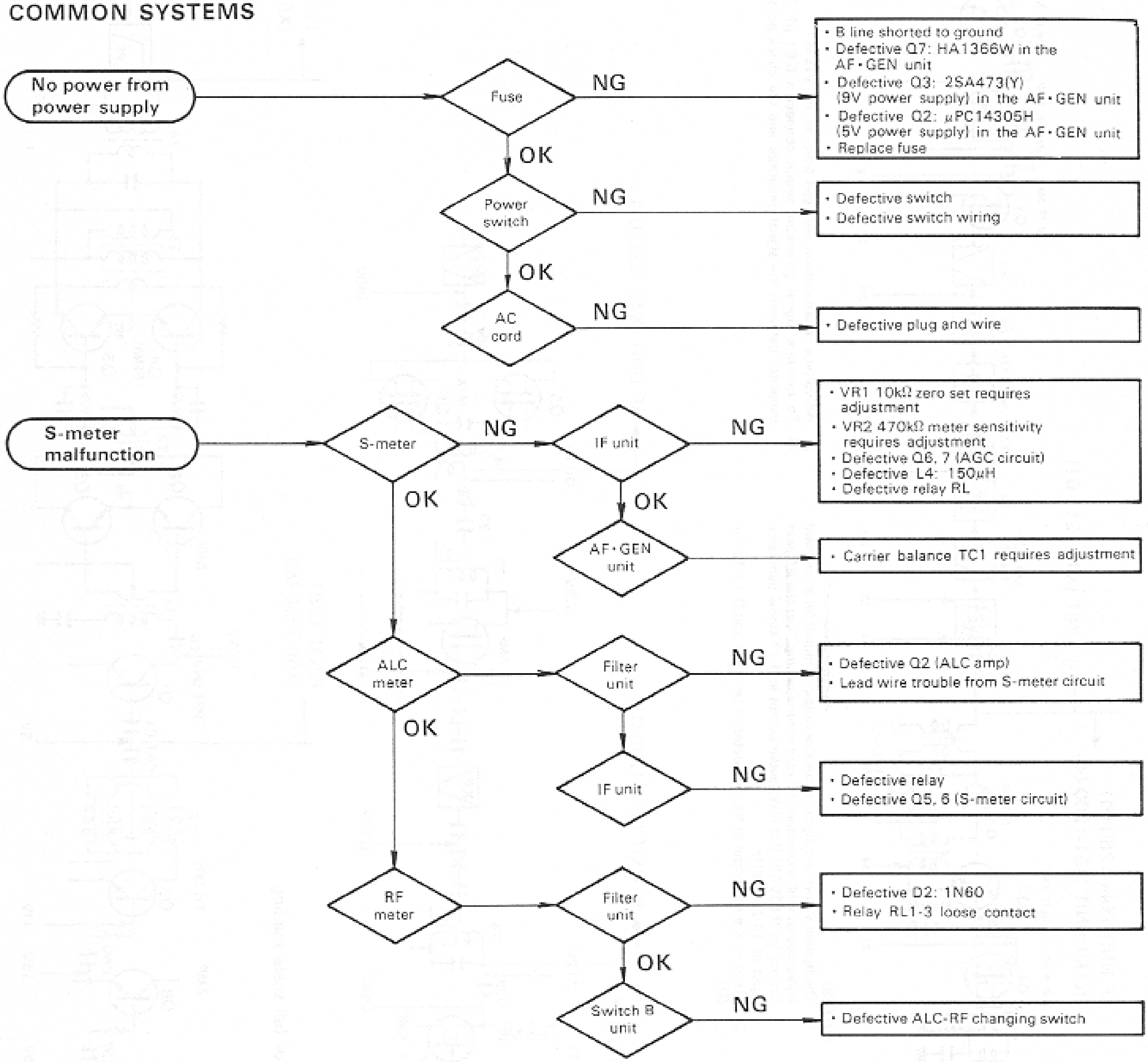
2SC2290
R (hfe 30～65)
O (hfe 55～95)
Y (hfe 85～150)

COUNTER SYSTEM

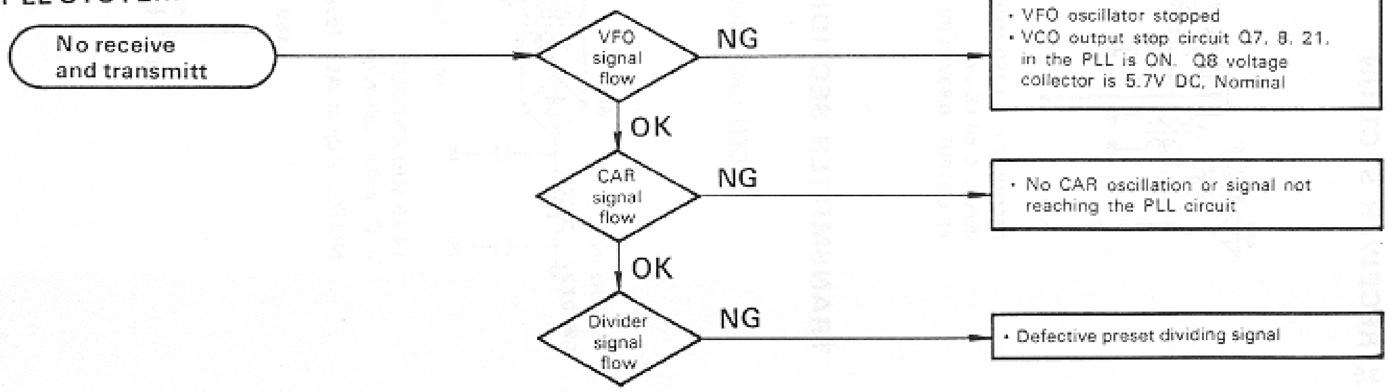


TROUBLE SHOOTING

COMMON SYSTEMS

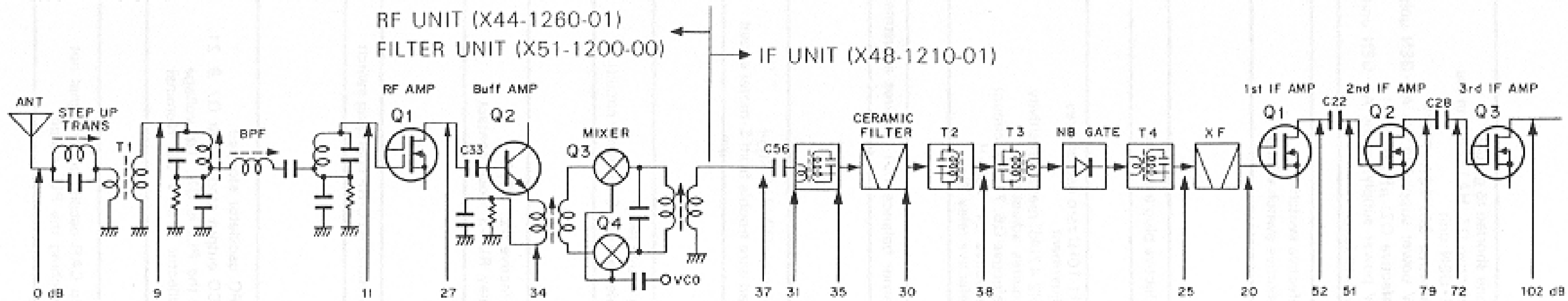


PLL SYSTEM



LEVEL DIAGRAM

RECEIVER SECTION

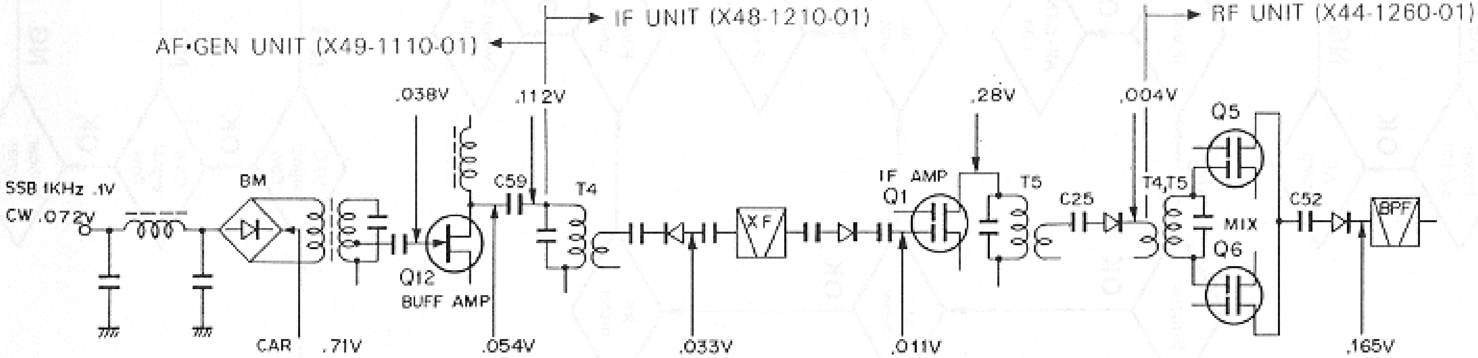


FREQUENCY: 14.250 MHz
INPUT: 0 dB (.5 μV)
AF OUTPUT: 0.63V at 8Ω

NOTES:

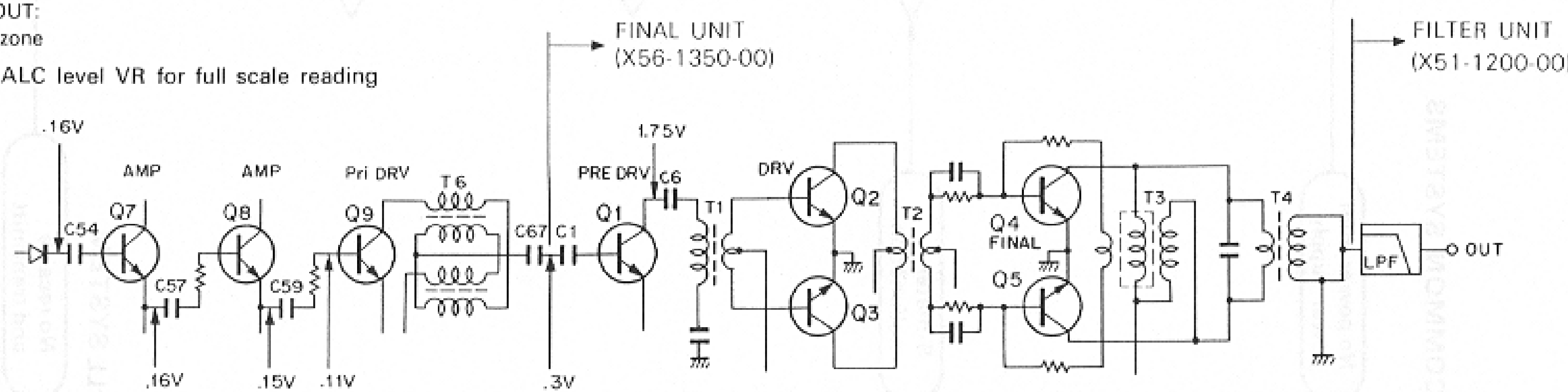
1) The figures shown are signal generator output required for a constant audio output with a constant AF gain control setting. Set the AF gain control for 0.63V/8Ω (50 mW) audio output at 0 dB signal generator input at 14.250 MHz.
2) Measure the AF output at the ring detector on the IF unit (X48-1210-01).
3) All voltage measurement are read from an RF VTVM.
4) To measure signal generator output connect a 0.01 μF 500 WV capacitor between the signal generator and the check point.

TRANSMITTER SECTION



14.25 MHz ANT OUT:
ALC: in full scale zone

NOTE: Adjust ALC level VR for full scale reading



ADJUSTMENTS

GENERAL

Adjustment procedures for this transceiver are classified into formal adjustments requiring a full service bench and simplified adjustment using a VTVM, AF and RF VITVM, AG, and AF and RF dummy load.

Complete adjustment also requires a frequency counter, SSG, sweep generator, etc.

(TX BPF, RX BPF, IF trap)

TEST EQUIPMENT REQUIRED

1. VTVM or DVM

1) Input resistance: More than 1 MΩ
2) Voltage range: 1.5 to 1000V AC/DC

NOTE:

A high-precision voltmeter may be used. However, accurate readings can not be obtained for high-impedance circuits.

2. RF VTVM

1) Input impedance: 1 MΩ and less than 3 pF, min.
2) Voltage range: 10 mV to 300 V
3) Frequency range: 50 MHz or greater

NOTE:

During adjustment special accuracy is not required (such as input level or PLL circuit carrier oscillator output), a VTVM or VOM may substitute for an RF VTVM by measuring through the output of a detector as shown in item 12.

3. AF VTVM

1) Frequency range: 50 Hz to 10 kHz
2) Input resistance: 1 MΩ or greater
3) Voltage range: 10 mV to 30 V

4. AF GENERATOR (AG)

1) Frequency range: 200 Hz to 5 kHz
2) Output: 2 mV~1 V, low distortion

5. AF DUMMY LOAD

1) Impedance: 8Ω
2) Dissipation: 3 W or greater

6. RF DUMMY LOAD

1) Impedance: 50 to 75Ω, 150Ω
2) Dissipation: 100W continuous or greater
3) Frequency limits: 1.8 to 30 MHz

The above-mentioned instruments may be used for simplified adjustment. For complete, precise adjustment, the following instruments are also necessary.

7. OSCILLOSCOPE

Requires high sensitivity, and external synchronization capability.

8. SWEEP GENERATOR

1) Center frequency: 8.83 MHz
2) Frequency deviation: Maximum ±5 kHz
3) Output voltage: More than 0.1V
4) Sweep rate: At least 0.5 sec/cm

9. Standard Signal Generator

1) Frequency range: 1.8 to 30 MHz
2) Output: −6 dB~120 dB (0.25 µV~0.5V)

NOTE:

Generator must be frequency stable.

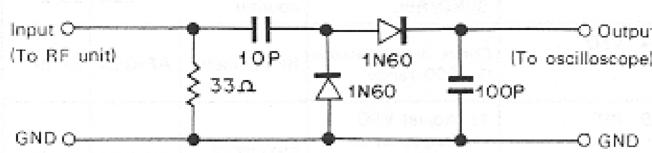
10. FREQUENCY COUNTER

1) Minimum input voltage: 50 mV
2) Frequency range: Greater than 40 MHz

11. NOISE GENERATOR

Must generate ignition noise containing harmonics beyond 30 MHz.

12. DETECTOR (TX B.P.F.)



REFERENCE

Japanese "SSG"	American "SG"
-6dB	0.25 µV
0 dB	0.5 µV
6 dB	1 µV
12 dB	2 µV
24 dB	8 µV
30 dB	15.8 µV
40 dB	50 µV
50 dB	158 µV
60dB	500 µV
70 dB	1.58 mV
80 dB	5 mV
90 dB	15.8 mV
100 dB	50 mV
120 dB	0.5 V

ADJUSTMENTS

PREPARATORY WORK

1. Remove the upper and lower cases as shown in figure 14. below.

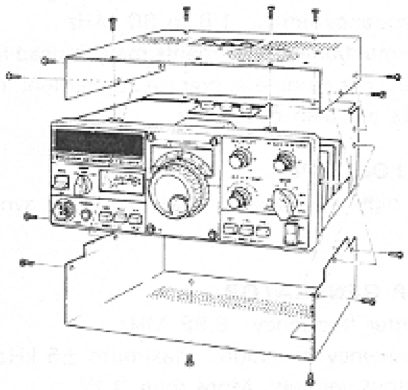


Fig. 14 Case disassembly

2. Unless otherwise specified, set the controls as follows.

AF GAIN	COUNTERCLOCKWISE
RF GAIN	FULL CLOCKWISE
MIC GAIN	CENTERED
CAR LEVEL	CENTERED
RIT	CENTERED
IF SHIFT	CENTERED
MODE	LSB
SEND/REC	REC
NB	OFF
CAL	OFF
RIT	OFF
FIX./VFO	VFO
ALC/RF	RF
VOX/MAN	MAN
POWER	ON

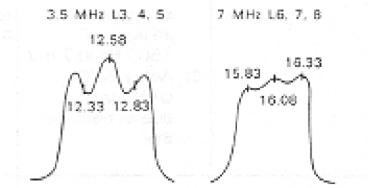
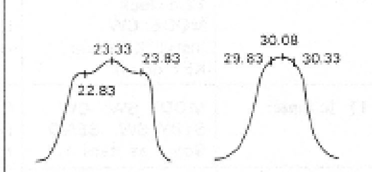
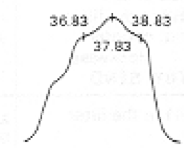
Item	Condition	Measuring point			Adjust			Specifications/Remarks
		Test equipment	Unit	Terminal	Unit	Part	Reference	
1. Power Supply Voltage 1) 9V set		DC VTVM	AF•GEN	J4, 4P	AF•GEN	VR-3	9V	
2) 2.8V				J4, 10P	AF•GEN	VR-2	2.8V	
3) AVB 11V	STBYSW→SEND		FILTER	AVB	FILTER	VR-4	11.0V	
2. CAR 1) CAR output		RF VTVM	AF•GEN	J3, 2P	CAR	T1	0.3Vrms	0.3V ±1 dB
2) Freq. RX	1) IF SHIFT centered 2) LSB MODE 3) USB MODE	Frequency counter	AF•GEN	J3, 2P	CAR CAR	TC2 TC1	8.82850 MHz 8.83150 MHz	
3) Freq. RX	CW MODE	Frequency counter	AF•GEN	J3, 2P	CAR	VR2	8.83070 MHz	
3. IF SHIFT	Alternate SEND/REC	Frequency counter	AF•GEN	J3, 2P	CAR	VR-1	RX and TX frequency no change	LSB: 8.82850 MHz
4. VFO	Check output across 0~500 range	RF voltmeter	AF•GEN	J1, 6P	VFO	TC2	0.2Vrms	0.2V±1 dB rms at VFO scale 250 0.2V±2 dB rms in FIX CH output
5. RIT	1) Adjust VFO frequency to 5.5 MHz 2) RIT control centered	Frequency counter	AF•GEN	J1, 6P	AF•GEN	VR1	Altenate RIT ON and OFF	1) No frequency change between RIT ON and OFF 2) More than ±1.5 kHz variable RIT range
6. VCO		DC VTVM	PLL	TP1	PLL	T1 T2 T3 T4 T5	WWV→3.5V (VFO: 00) 14 MHz→3.5V (VFO: 500) 21 MHz→3.5V (VFO: 250) 28.0→5.0V (VFO: 500) or 29.0→5.0V (VFO: 0) 7 MHz→5.5V (VFO: 250) 3.5 MHz→3.5V (VFO: 250)	Oscillator level 1V ±2 dB (see table below)

Oscillator level 1V ±2 dB

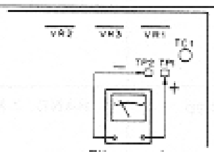
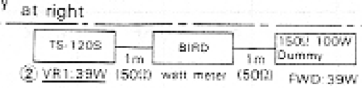
	"0"	"250"	"500"
WWV	(3.5V) 23.33 MHz	23.58 MHz	23.83 MHz
3.5 M	12.33 MHz	(3.5V) 12.58 MHz	12.83 MHz
7.0 M	15.83 MHz	(5.5V) 16.08 MHz	16.33 MHz
14.0 M	22.83 MHz	23.08 MHz	(3.5V) 23.33 MHz
21.0 M	29.83 MHz	(3.5V) 30.08 MHz	30.33 MHz
28.0 M	36.83 MHz	37.08 MHz	37.33 MHz
28.5 M	37.33 MHz	37.58 MHz	(5.0V) 37.33 MHz
29.0 M	(5.0V) 37.83 MHz	38.08 MHz	38.33 MHz
29.5 M	38.33 MHz	38.58 MHz	38.83 MHz

Note ( ) control voltage

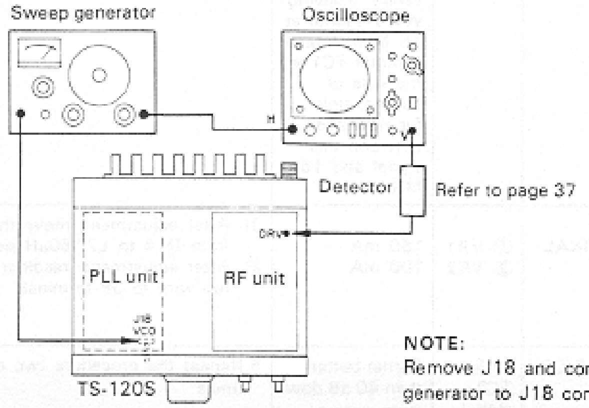
ADJUSTMENTS

Item	Condition	Measuring point			Adjust			Specifications/Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference	
7. TX BPF	Maintain adjustment order 3.5 MHz, 7.5 MHz, 14 MHz, 21 MHz, 28 MHz	Sweep generator Oscilloscope Detector	RF PLL	DRV VCO	RF	L3～17	Adjust coils for waveform as shown at right (Fig. 15)	Ripple ratio less than 5 dB Ripple ratio less than 2 dB
8. RX BPF	This adjustment requires a spectrum analyzer and tracking generator. Otherwise adjust as in item 7.	Tracking generator Spectrum analyzer	Rear panel RF	ANT Q2, E	RF	L3～17	Same as above (Fig. 16)	Ripple ratio less than 2 dB Ripple ratio less than 1 dB
9. IF AMP	1) VFO: 250 BAND: 14 MHz MODE: USB	SSG Oscilloscope AF VTVM 8Ω dummy or speaker		SP	RF IF	T3 T1～17	1) Adjust for a maximum output 2) Apply SSG output at (.25 μV) −6 dB to the antenna terminal signal to noise ratio approx. 15 dB	Ripple ratio less than 2 dB
10. IF trap	1) BAND: 7 MHz 2) BAND: 14 MHz	SSG AF VTVM		SP	RF	L1, 2 L35	Adjust for minimum S-meter reading and AF output level. repeat the procedure two or three times.	Check for 80 dB attenuation of 8.83 MHz signal. (Fig. 17)
11. NB	Connect the noise generator to ANT terminal. S-meter reading S5～7.	Noise generator Oscilloscope	IF	D14(K) (cathode)	RF IF	T3 T1	Adjust for a wave form as shown at right. repeat the procedure two or three times	Before adjustment After adjustment
12. Counter standard Oscillator	BAND: WWV VFO: 500 (15.000 MHz) CAL ON	ANT			Freq. count.	TC1	Set the BAND switch to WWV dial scale: 500) connect an antenna to the set. While receiving WWV Signal at 15 MHz, adjust trimmer TC1 at the side of counter unit for zero beat between this signal and 15 MHz	Set for zero beat between WWV and CAL
13. Base current	MODE: LSB MIC: Counter-clockwise BAND: 14 MHz SEND position	RF power meter Current meter	FINAL	① D14terminal to⊕ L7 150μH side to⊖ ② F14-3P	FINAL	① VR1 ② VR2	150 mA 100 mA	1) After adjustment, move the wire from D14 to L7 150μH side. 2) After adjustment, resolder red wire to 3P terminal.
14. Carrier suppression	Adjust at 14 MHz for RF full CW power. Switch to SSB position. No input	Power meter Oscilloscope Direction coopler		ANT	AF•GEN	VR5 TC2 (Min.) *	Carrier better than 40 dB down from output signal	* Repeat the procedure two or three times

ADJUSTMENTS/TEST SET UP

Item	Condition	Measuring point			Adjusting point			Specifications/Remarks
		Instruments	Unit	Terminal	Unit	Parts	Reference	
15. Carrier point	1) Connect AG to MIC terminal and apply an input of 1500 Hz at 7 mV 2) Adjust MIC GAIN until output becomes 5W	RF power meter Oscilloscope AG AF VTVM		ANT	CAR	USB → TC1 LSB → TC2	Shift the AF signal between 300 Hz and 2700 Hz adjust TC1 (in USB) and TC2 (in LSB) so RF output reading is equal high and low level.	400 Hz, 2600 Hz (−6 dB down) 1500 Hz: Centered Check carrier suppression if carrier point is adjusted. Adjust TC1 (in USB) and TC2 (in LSB) so RF reading is the same.
16. Side tone	AF GAIN: 12 o'clock MODE: CW Install KEY and KEY down	KEY AF VTVM			AF-GEN	VR4	0.63V/8Ω	
17. Ic meter	MODE SW: CW STBY SW: SEND Same as item 13	Power meter DC current meter			FILTER	VR4	11A	When same as item 13-②, Adjust CAR level, IC meter reading to 11A.
18. ALC	BAND: 14 MHz VFO: 200 MODE: CW VR2 in the filter Unit: counter-clockwise STBY: SEND	RF power meter, AG, AF VTVM			FILTER	VR3 VR2	95W 75W (28.5 MHz)	Check that RF output power is the same level input. SSB position at 7 mV (1500 Hz) input.
19. Protection	VR1 in the filter Unit: Full clockwise Same as above Refer to 42 page	RF VTVM DC volt meter, coaxial cable (50Ω), "BIRD" Watt meter, 150Ω, 100W dummy.	FILTER 50Ω dummy	TP1 and ① TP2 as shown at right	FILTER	TC1	MIN. (Approx. 0.2～0.4V)	 Filter unit
				 ② VR1:39W				
19. S-meter 1) Starting level 2) S1 3) S9	Adjust 14, 175 MHz in receive position	SSG			1) IF 2) IF 3) IF	1) VR1 2) T6 3) VR2	1) 100 dB to the antenna from SSG → S9 +60 dB. 2) 8 dB to the antenna from SSG → S1 3) 40 dB (50 μV) to the antenna from SSG → S9	2) Less than 8 dB ±4 dB 3) Less than 40 dB ±6 dB

TEST AND ALIGNMENT SET-UP



NOTE:
Remove J18 and connect the sweep generator to J18 connector (pin 1).

Fig. 15 Test equipment connection/Item 7 TX BPF

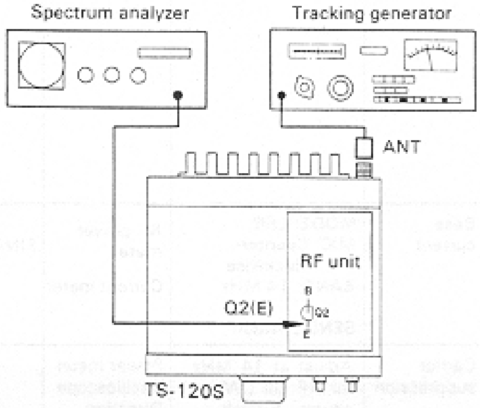
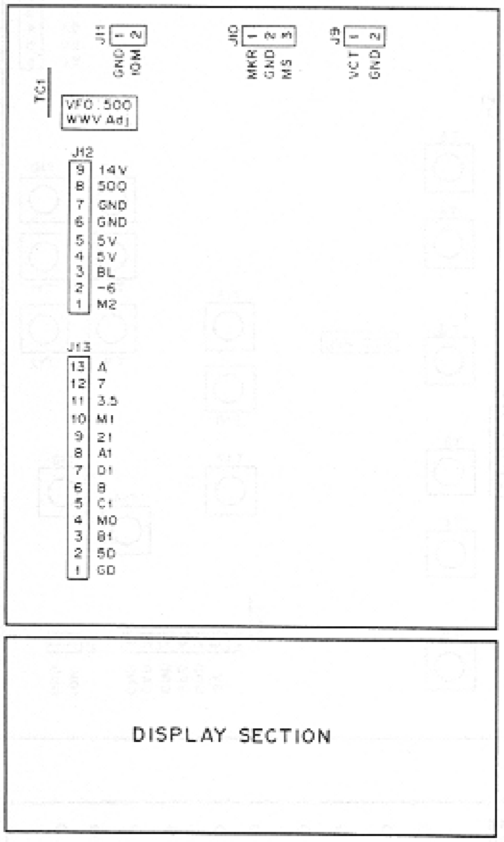


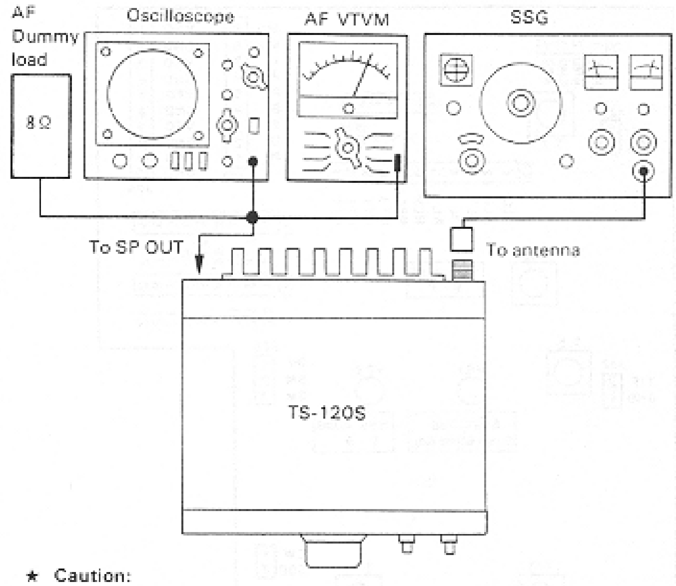
Fig. 16 Test equipment connection/Item 8 RX BPF

TEST AND ALIGNMENT SET-UP

PC BOARD ALIGNMENT

▼ COUNTER UNIT (X54-1360-00)

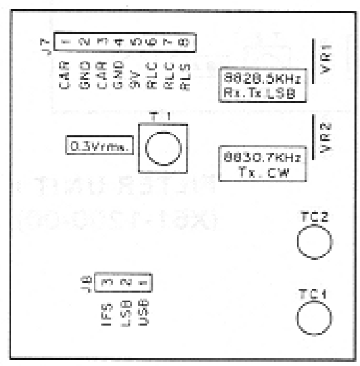




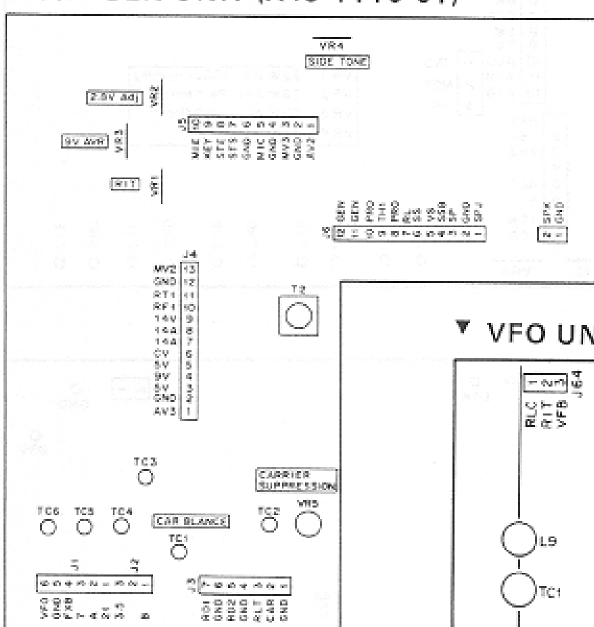
★ Caution:
NEVER TRANSMIT with SSG at antenna terminal.

Fig. 17 Test equipment connection/Item 9 IF AMP, Item 10 IF TRAP

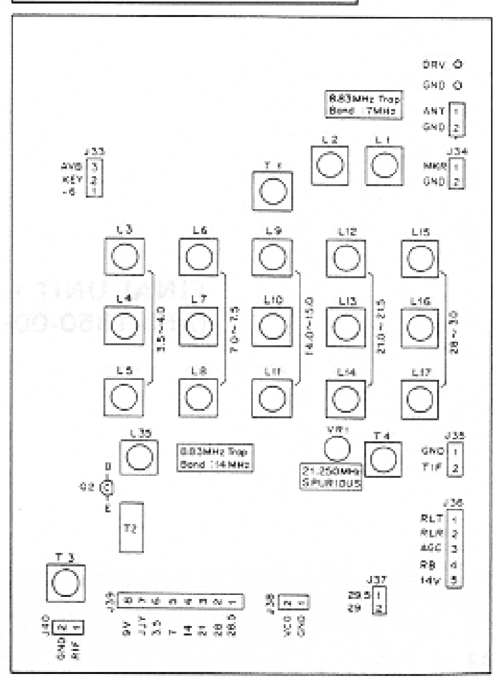
CAR UNIT ► (X50-1500-00)



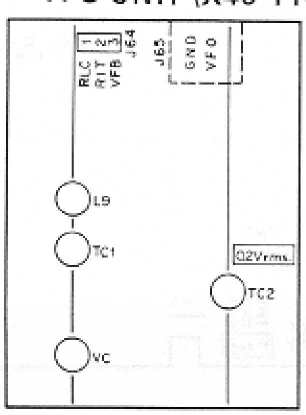
▼ AF·GEN UNIT (X49-1110-01)



RF UNIT ► (X44-1260-01)

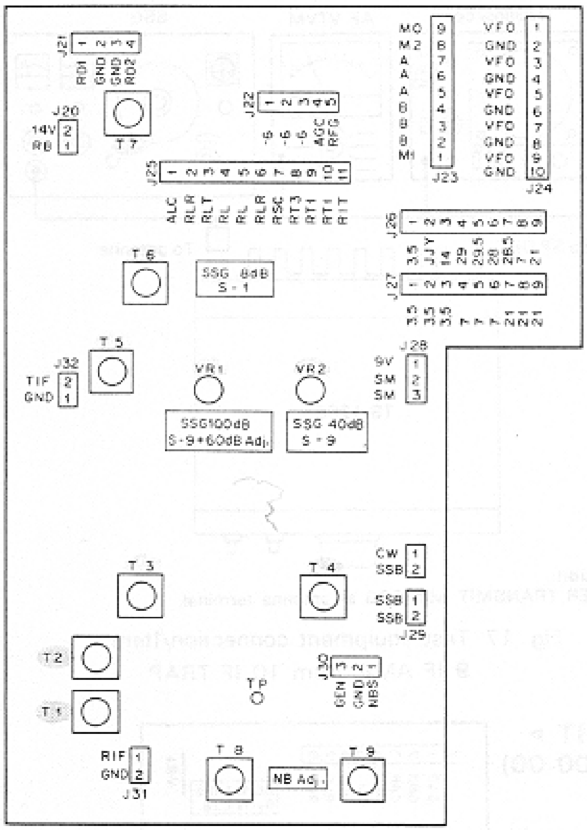


▼ VFO UNIT (X40-1130-00)

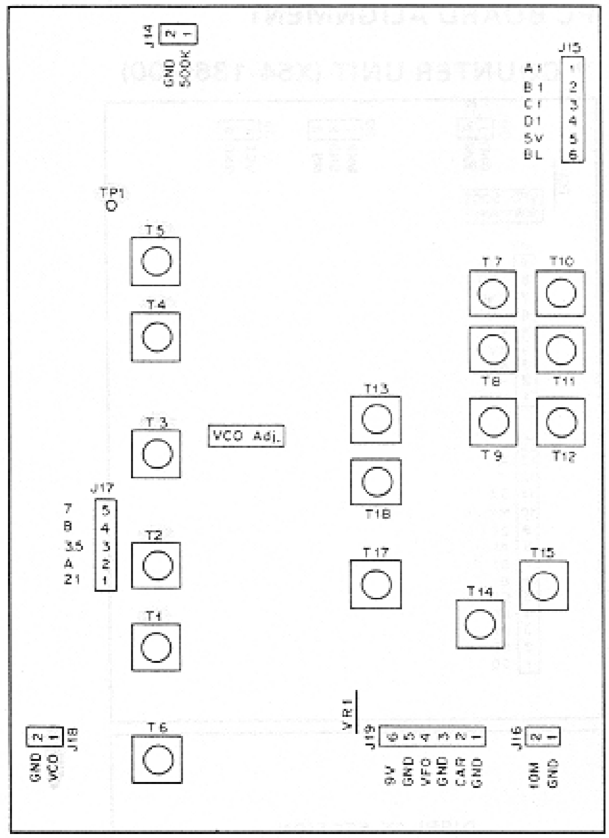


PC BOARD ALIGNMENT

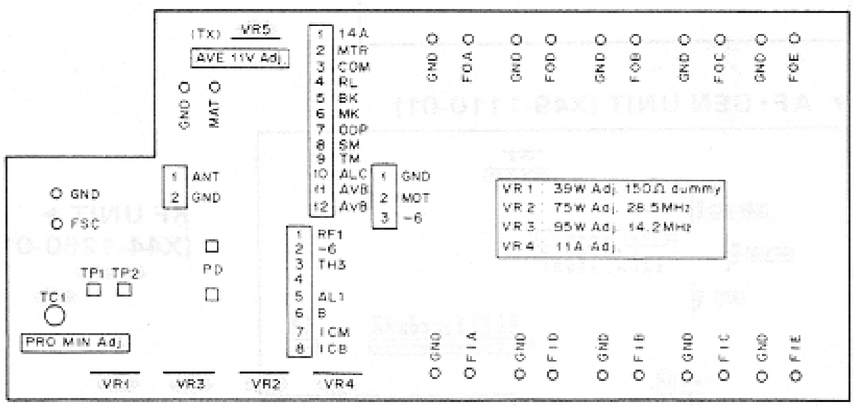
▼ IF UNIT (X48-1210-01)



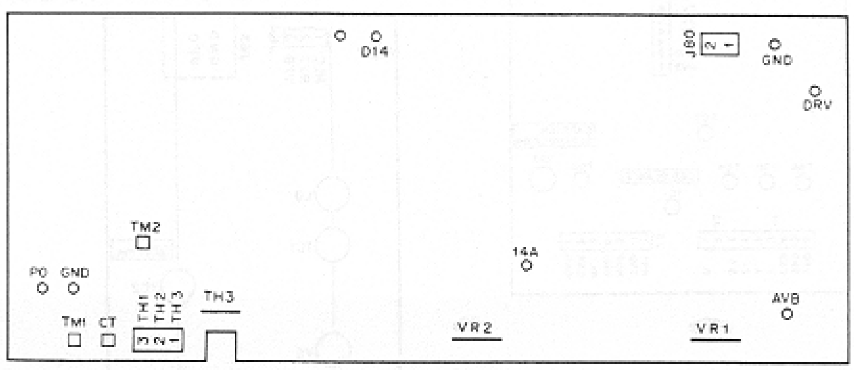
PLL UNIT (X50-1490-00)



FILTER UNIT ▶ (X51-1200-00)



FINAL UNIT ▶ (X56-1350-00)



PS-30

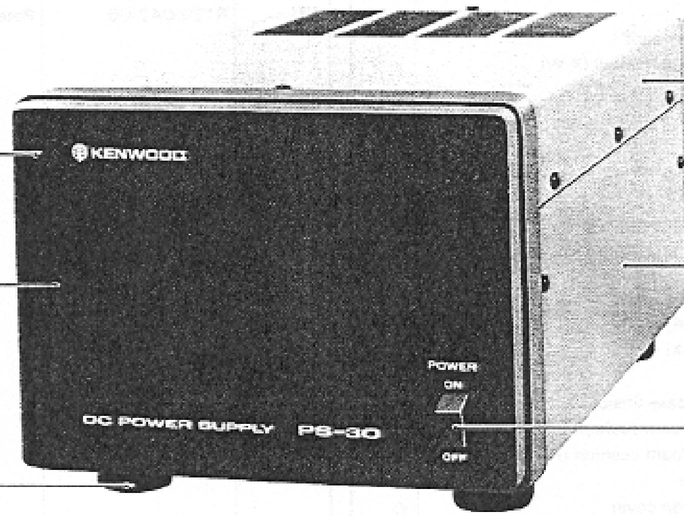
SPECIFICATION

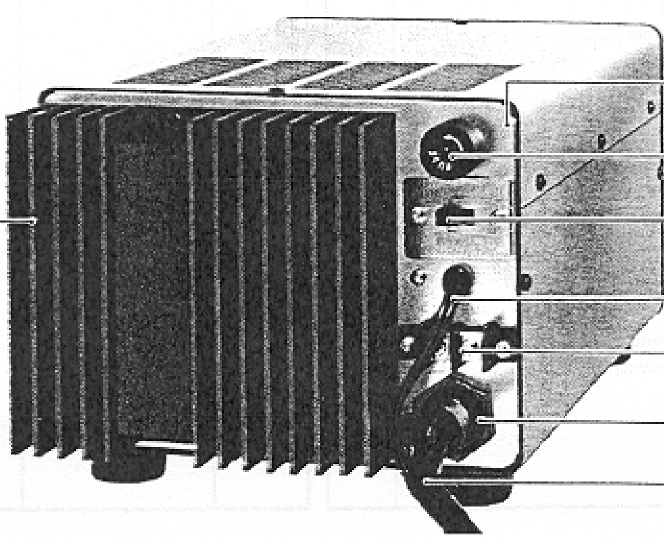
[Power Supply Section]

Input voltage:	AC 120V/220V or 220V/240V ± 10%, 50/60 Hz
Output voltage:	DC 13.8V (standard voltage)
Output current:	20A (intermittent load 50% cuty cycle)
Continuous load current:	15A max. (inclusive of external output terminal)
Output voltage fluctuation:	Within ±0.7V at AC 120V, 220V, 240V ± 10% (Load current: 15A) Within 0.7V at 2～15A of load current (No-load output voltage: Less than 16V at AC 120V, 220V, 240V)
Ripple voltage:	Less than 20 mV (rms), output current 15A
Power consumption:	Approx. 470W at AC 120V, 220V, 240V, (Load current: 20A)

[General]

Dimensions:	180 (7"—1/16)W × 133 (5"—1/4)H × 287 (11"—5/16)D mm (inch)
Weight:	Approx. 8.9 kg (19.6 lbs.)



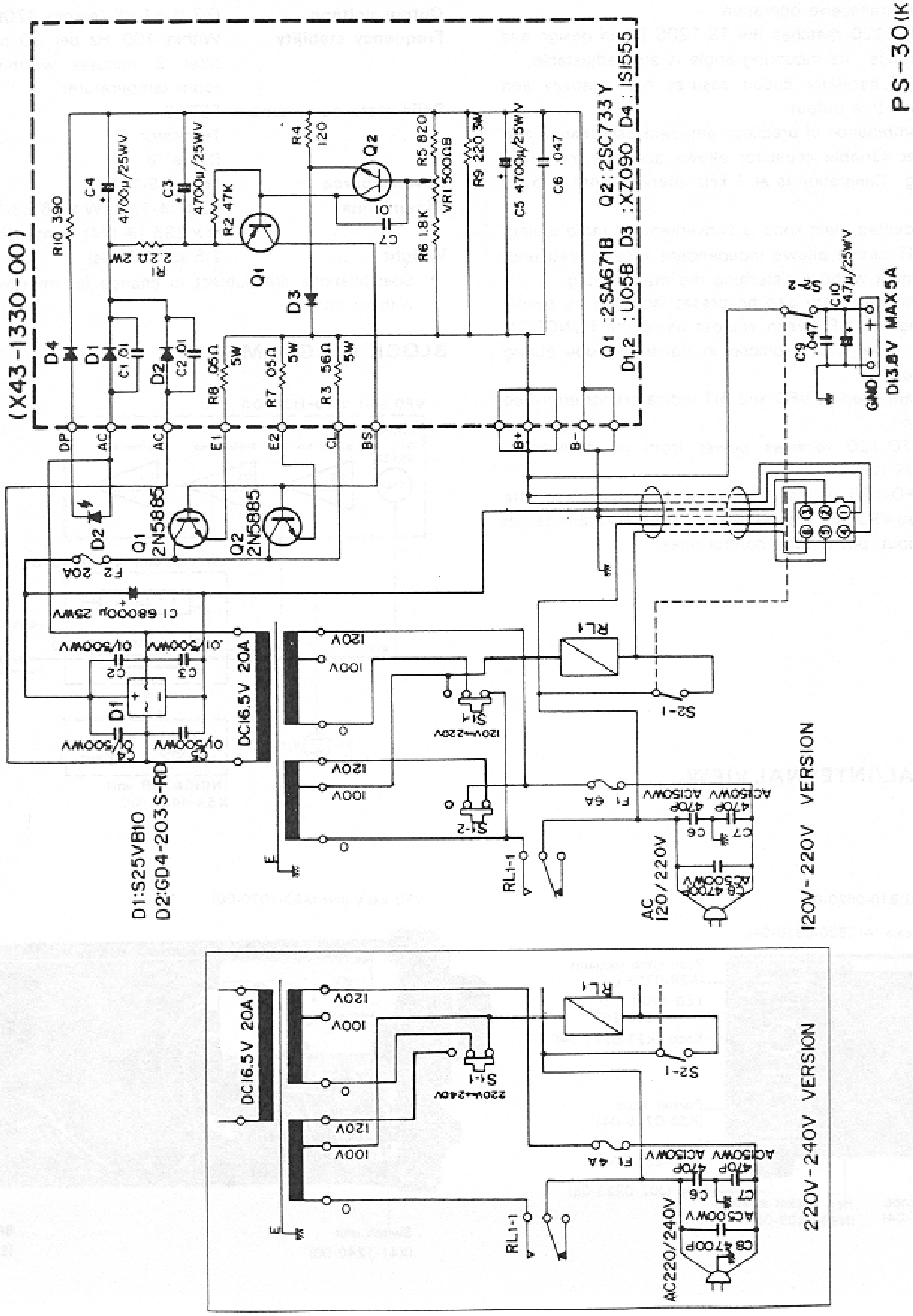


<PS-30 PARTS LIST>

Ref. No.	Parts No.	Description	Re-marks
GENERAL			
C1	C90-0813-05	Electrolytic 6800μF 25WV	☆
C2~5	CK45E2H103P	Ceramic 0.01μF +100, −0%	
C6,7	C90-0300-05	Ceramic 470pF AC150WV	
C8	C91-0412-05	Ceramic 470pF AC500WV	
C9	CK45F1H473Z	Ceramic 0.047μF +80%−20%	
C10	CE04W1E4R7	Electrolytic 4.7μF 25WV	
Q1,2	V08-1012-06	Transistor 2N5885	☆
D1	V11-1365-06	Diode S25VB10	☆
−	V11-7260-56	LED GD4-203S-RD	☆
RL1	S51-1406-05	Relay	☆
−	A01-0746-12	Case (upper)	☆
−	A01-0755-02	Case (Lower)	☆
−	A20-2363-03	Front panel (T)	☆
−	A20-2364-03	Front panel (K,W)	
−	A23-1432-02	Rear panel (K)	☆
−	A23-1433-02	Rear panel (W,T)	
−	B46-0058-00	Warranty card	
−	B50-2652-00	Operating manual (K,W)	☆
−	B50-2656-00	Operating manual (T)	
−	E20-0282-05	2P Terminal plate	
−	E22-0207-05	Lug plate × 3	
−	E30-0545-05	AC cord with plug	
−	E31-0500-05	Power cord with plug	☆
	F01-0738-03	Heat sink	☆
−	F05-2035-05	Fuse (2A)	☆
−	F05-6021-05	Fuse (6A) × 2 (K)	
−	F05-4022-05	Fuse (4A) (W,T)	
−	H01-2623-04	Carton case (inside)	☆
−	H10-2523-02	Styren foam cushion (F)	☆
−	H10-2524-02	Styren foam cushion (R)	☆
−	H12-0455-04	Cushion	☆
−	H20-1413-03	Protection cover	☆
−	H25-0029-04	Protection bag (60 × 110mm)	
−	J02-0049-14	Leg × 6	
−	J13-0033-15	Fuse holder	
−	J19-0509-04	LED holder	
−	J32-1030-14	○○○○○ × 2	
−	J41-0006-5	Cord bush (K)	
−	J41-0024-15	Cord bush (W,T)	
−	J42-0403-05	Cord bush	
−	J61-0019-05	Vinyle tie × 7	
−	L01-8066-15	Power transformer	☆
−	X43-1330-00	AVR Unit	☆
	S31-2027-05	Slide switch	
	S36-2402-05	Power switch	☆

Ref. No.	Parts No.	Description	Re-marks
AVR UNIT (X43-1330-00)			
C1,2	CK45F1H103Z	Ceramic 0.01μF +80%−20%	
C3~5	C90-0814-05	Electrolytic 4700μF 25WV	☆
C6	CK45F1H473Z	Ceramic 0.047μF +80%−20%	
C7	CK45F1H103Z	Ceramic 0.01μF +80%−20%	
R2~10	RD14BB2E○○○J	Carbon resistor ○○○Ω ±5% 1/4W	
R1	RS14GB3D2R2J	Resistor (Metal film) 2.2Ω ±5% 2W	
R3	R92-0622-05	Resistor (cement) 56Ω 5W	
R7,8	R92-0619-05	Resistor (cement) 50mΩ 5W	
R9	RS14GB3F221J	Resistor (metal film) 220Ω ±5% 3W	
Q1	V01-0139-05	Transistor 2SA671TDB	
Q2	V03-0183-05	Transistor 2SC733 (Y)	
D1,2	V11-0270-05	Diode U05B	
D3	V11-4167-06	Zener diode XZ-090	
D4	V11-0076-05	Diode 1S1555	
VR1	R12-0042-05	Potentiometer 500Ω (B)	

PS-30



(X43-1330-00)
PS-30(K),(W)
Q1 :2SA671B Q2:2SC733Y
D1,2 :U05B D3 :XZ090 D4 :1S1555
D13.8V MAX5A
D1:S25VB10
D2:GD4-203S-RD
DC16.5V 20A
C1 6800μ 25WV
F2 20A
Q1 2N5885
Q2 2N5885
F1 6A
RL1
S2-1
S2-2
120V-220V VERSION
AC 120/220V
220V-240V VERSION
AC220/240V
F1 4A

VFO-120 FEATURES/BLOCK DIAGRAM/SPECIFICATIONS/EXTERNAL VIEW/ INTERNAL VIEW

FEATURES

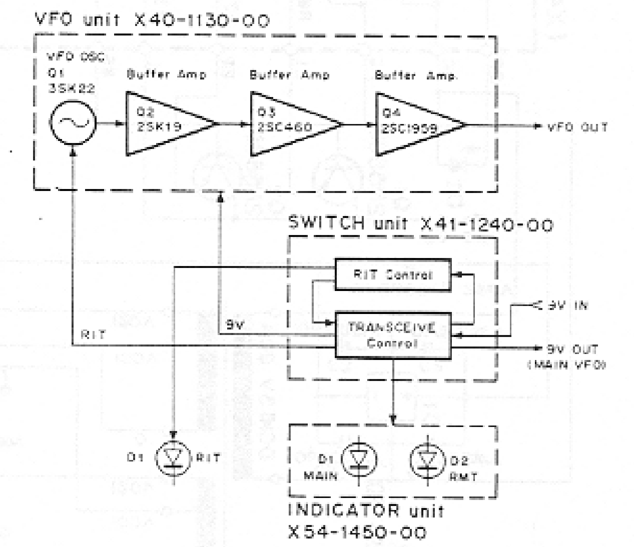
1. The model VFO-120 is a remote VFO designed for use with the TS-120S (V) SSB transceiver, permitting cross-channel transceive operation.
2. The VFO-120 matches the TS-120S (V) in design and appearance. Its mounting angle is also adjustable.
3. The FET oscillator circuit assures high stability and distortion-free output.
4. The combination of precision anti-backlash gearing and a linear variable capacitor allows accurate frequency reading. Calibration is at 1 kHz intervals from 0 to 25 kHz.
   The indented main knob is convenient for rapid tuning.
5. The RIT circuit allows independent receive frequency adjustment without disturbing the main tuning.
6. Transmit frequency can be preset (spotted) by simply pressing the T-F switch without using the FUNCTION switch. The VFO is placed in transmit mode during reception.
7. LED's are used as VFO and RIT indicators for error-free operation.
8. The VFO-120 receives power from its companion TS-120S (V).
9. The VFO-120 is installed by simply connecting the supplied VFO and ground cables. The VFO cable carries the output, power, and control lines.

SPECIFICATIONS

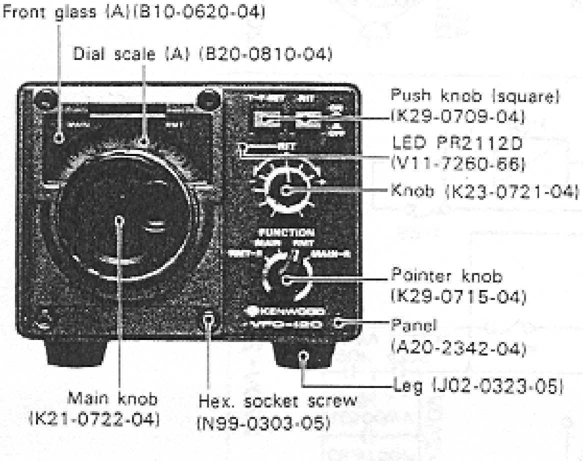
Oscillator frequency	5.50～6.00 MHz
Oscillator circuit	Clapp
Output voltage	0.2 V ±1 dB (across 470Ω load)
Frequency stability	Within 100 Hz per 30 minutes after 3 minutes warm-up (at room temperature).
Solid-state complement	FET: 2 Transistor: 2 Diode: 6
Power source	From TS-120V
Dimensions	123 (4-7/8) W × 96 (3-13/16) H × 235 (9-1/4) D mm (inch)
Weight	2.5 kg (3.5 lbs)

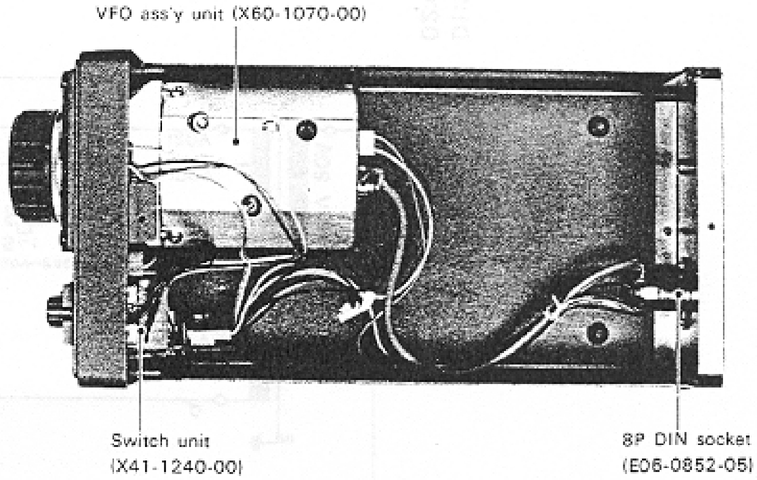
* Specifications are subject to change for improvement without notice.

BLOCK DIAGRAM



EXTERNAL/INTERNAL VIEW





☆ Mark denotes New Part

VFO-120 PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
General			
—	A01-0739-03	Case (A) upper	☆
—	A01-0740-03	Case (B) lower	☆
—	A20-2341-04	Panel	☆
—	A23-1430-04	Rear panel	☆
—	B39-0407-04	Spacer × 2 for leg	
—	B46-0058-00	Warranty card (K)	
—	B50-2633-00	Operating manual (K), (W)	☆
	B50-2634-00	Operating manual (T)	☆
—	E02-0107-05	Diode socket	☆
—	E06-0852-05	8P DIN socket	☆
—	E30-1628-05	VFO cable	☆
—	H01-2609-04	Carton (K), (W)	☆
—	H01-2610-02	Carton (T)	☆
—	H10-2513-02	Front packing fixture	
—	H10-2514-02	Rear packing fixture	
—	H12-0445-04	Cushion	
—	H20-1407-03	Protective cover	
—	H25-0117-04	Polyethylene bag 80 × 250	
—	J02-0323-05	Leg × 4	
—	J02-0409-04	Assistance leg	
—	J42-0412-04	Knob bush	☆
—	J61-0019-05	Vinyle tie × 5	
—	K23-0721-04	Knob (RIT)	☆
—	K29-0715-04	Pointer knob (FUNCTION)	☆
—	K29-0709-04	Push knob (square)	
—	N99-0303-05	Hex. socket screw × 4 (VFO M4 × 10)	
D1	V11-7260-66	LED PR2112D	
—	X41-1240-00	Switch unit	☆
—	X60-1070-01	VFO ass'y unit	☆

SWITCH UNIT (X41-1240-00)

Ref. No.	Parts No.	Description	Re-marks
CAPACITOR			
C1	CH45F1H103Z	Ceramic	
POTENTIOMETER/SWITCH			
VR1	R01-2404-05	5kΩ (B) (RIT)	
VR2	R12-3025-05	10kΩ (B)	
S1	S29-1410-05	Slide rotary switch SRG-R4	☆
S2	S40-2409-15	Push switch T. F SET SW	
S3	S40-2404-05	Push switch RIT SW	☆
RELAY/SEMICONDUCTOR			
RL1	S51-2408-05	Relay G2V-2	
D1	V11-0219-05	Diode V06B	

VFO ASS'Y UNIT (X60-1070-00)

Ref. No.	Parts No.	Description	Re-marks
GENERAL			
—	B01-0621-05	Dial escutcheon	☆
—	B10-0620-04	Front glass (A)	☆
—	B20-0810-04	Dial scale (A)	☆
—	B20-0811-04	Dial scale (B)	☆
—	B30-0808-05	Pilot lamp	
—	K21-0722-04	Main knob	☆
—	N19-0608-04	Washer × 2	☆

Ref. No.	Parts No.	Description	Re-marks
—	X40-1130-00	VFO unit	☆
—	X54-1450-00	Indicator unit	☆

VFO UNIT (X40-1130-00)

Ref. No.	Parts No.	Description	Re-marks
CAPACITOR			
C1	CK45F1H103Z	Ceramic 0.01μF +80, −20%	
C2	CC45SL1H390J	Ceramic 39pF ±5%	
C3	CC45CH1H100D	Ceramic 10pF ±0.5pF	
C4	CC45SL1H390J	Ceramic 39pF ±5%	
C5	CK45B1H102K	Ceramic 1000pF ±10%	
C6	CK45F1H223Z	Ceramic 0.022μF +80, −20%	
C7	C90-0262-05	Ceramic 0.047μF 25WV	
C8	CC45CH1H020C	Ceramic 2pF ±0.25pF	
C9	CK45F1H223Z	Ceramic 0.022μF +80, −20%	
C10, 11	C90-0262-05	Ceramic 0.047μF 25WV	
C12	CC45SG1H050C	Ceramic 5pF ±0.25pF	
C13	CC45LG1H470J	Ceramic 47pF ±5%	
C14	CC45LG1H220J	Ceramic 22pF ±5%	
C15, 16	CC45LG1H151J	Ceramic 150pF ±5%	
C17	CC45SG1H150J	Ceramic 15pF ±5%	
C18	CC45RG1H120J	Ceramic 12pF ±5%	
C19	CC45LG1H151J	Ceramic 150pF ±5%	
C20	CC45CG1H121J	Ceramic 120pF ±5%	
C21	CK45F1H103Z	Ceramic 0.01μF +80, −20%	
RESISTOR			
R1 ~ 14	RD14CB2E○○○J	Carbon resistor○○○Ω ±5% 1/4W	
SEMICONDUCTOR			
Q1	V09-0020-05	FET 3SK22 (Y)	
Q2	V09-0011-05	FET 2SK19 (Y)	
Q3	V03-0079-05	Transistor 2SC460 (B)	
Q4	V03-1959-06	Transistor 2SC1959 (Y)	
D4	V11-0414-05	Diode 1S2588	
D5	V11-4161-36	Varicap diode 1SV53A	
TRIMMER/VC/INDUCTOR/COIL			
TC1	C05-0305-05	Ceramic trimmer 12pF	
TC2	C05-0013-15	Ceramic trimmer 20pF	
—	C02-0010-05	Variable capacitor	☆
L1, 2	L40-4711-03	Ferri inductor 470μH	
L3	L40-1501-03	Ferri inductor 15μF	
L5 ~ 7	L40-4711-03	Ferri inductor 470μH	
L8	L33-0025-05	Choke coil 1μH	
L9	L32-0609-05	Oscillator coil B	☆
L10	L32-0608-05	Oscillator coil A	☆
MISCELLANEOUS			
—	B42-1645-04	Indication tape	☆
—	D22-0405-04	Coupling	☆
—	D40-0604-05	Dial mechanism	☆
—	E13-0163-05	1P Pin jack	
—	E23-0046-04	Terminal (square) × 4	

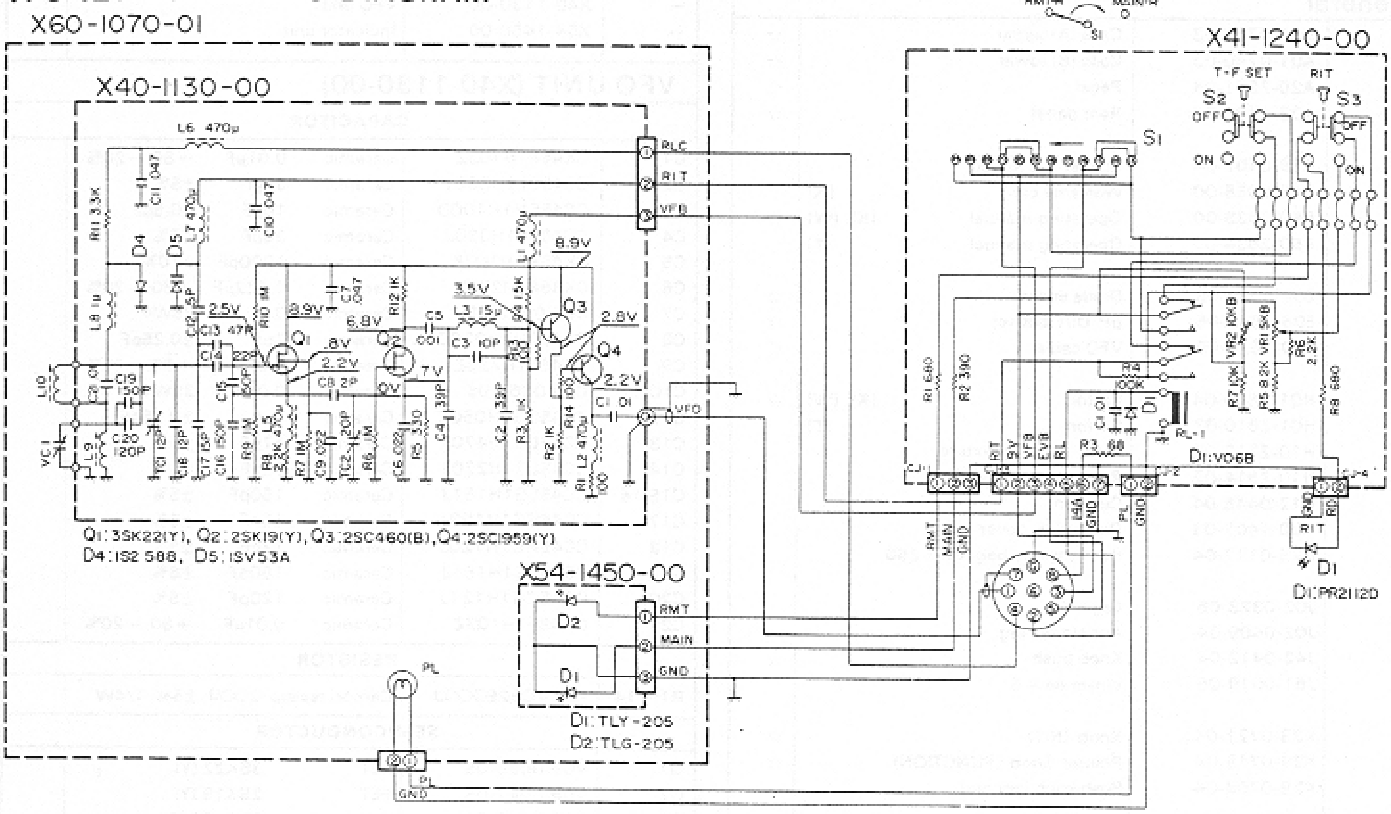
INDICATOR UNIT (X54-1450-00)

Ref. No.	Parts No.	Description	Re-marks
SEMICONDUCTOR			
D1	V11-3163-16	LED TLY-205	
D2	V11-3162-86	LED TLG-205	

SCHEMATIC DIAGRAM/SPECIFICATIONS/PARTS LIST

NOTE: The circuit and ratings may change without notice due to developments in technology.

VFO-120 SCHEMATIC DIAGRAM



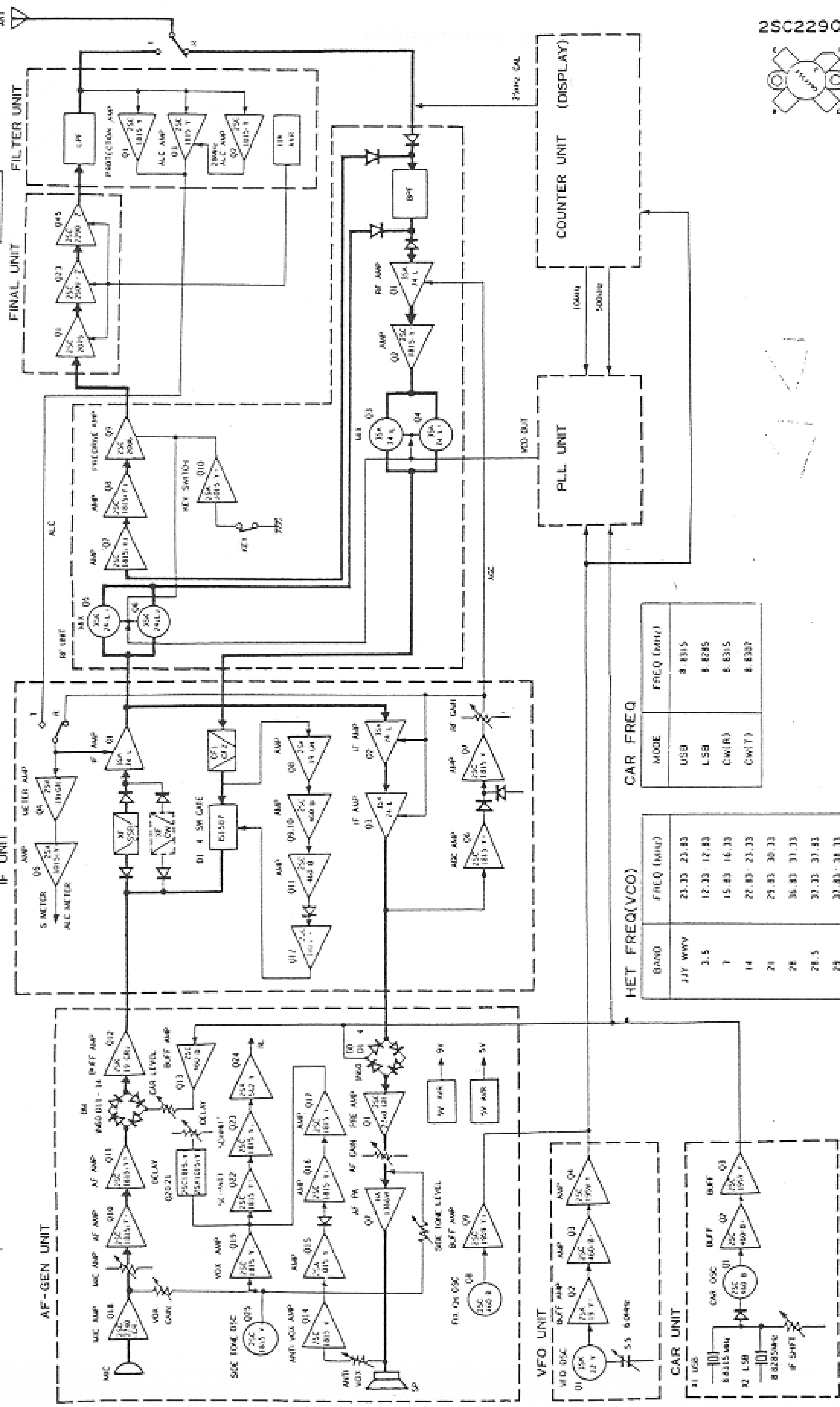
VFO-120 SPECIFICATIONS

Speaker size:	3"
Rated input:	1.0 watts
Impedance:	8 ohms
Frequency response:	300 Hz to 5 kHz
Dimensions:	4-7/8" wide × 3-3/4" high × 9-1/3" deep (excluding feet)
Weight:	3.1 lbs.

SP-120 PARTS LIST

Ref. No.	Parts No.	Description	Re-marks
—	A01-0739-03	Case (A)	☆
—	A01-0740-03	Case (B)	☆
—	A20-2343-03	Panel	☆
—	A23-1431-04	Rear panel	☆
—	B04-0401-04	SP grill	☆
—	B07-0613-04	SP ring	☆
—	B39-0407-04	Spacer × 2	
—	B50-2636-00	Operating manual (K), (W)	☆
—	B50-2637-00	Operating manual (T)	☆
—	E20-0208-04	Terminal plate	
—	G53-0507-04	Packing × 4	☆
—	H01-2611-04	Carton	☆
—	H10-2513-02	Front packing fixture	
—	H10-2514-02	Rear packing fixture	
—	H12-0445-04	Cushion	
—	H20-1407-03	Protective cover	
—	H25-0077-03	Polyethylene bag	
—	J02-0323-05	Leg × 4	
—	J02-0409-04	Assistance leg	
—	J21-1144-14	Speaker mounting hardware × 2	
—	J61-0019-05	Vinyle tie	
—	T07-0204-05	Speaker	☆

BLOCK DIAGRAM

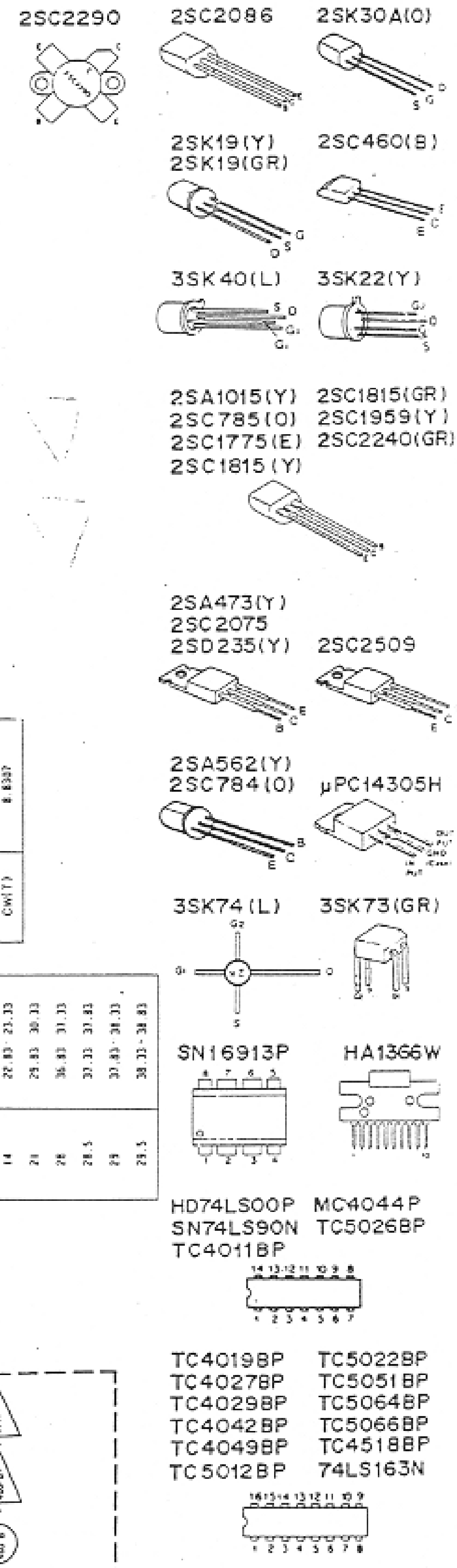


CAR FREQ

MODE	FREQ (MHz)
USB	8.8315
LSB	8.8285
CW(R)	8.8315
CW(T)	8.8307

HET FREQ(VCO)

BAND	FREQ (MHz)
JJY WWV	23.33 - 23.83
3.5	12.33 - 12.83
7	15.83 - 16.33
14	22.83 - 23.33
21	29.83 - 30.33
28	36.83 - 37.33
28.5	37.33 - 37.83
29	37.83 - 38.33
29.5	38.33 - 38.83



VFO-120 FEATURES/BLOCK DIAGRAM/EXTERNAL VIEW/INTERNAL VIEW/CIRCUIT DESCRIPTION

FEATURES

1. The AT-120 is a high performance HF antenna tuner and is a modification of the popular AT-200 antenna tuner. The AT-120 is small and light, and is suitable not only for operation in your HAM shack but also for mobile of field operation.
2. The AT-120 is designed to be used on all Amaeur bands meter, and an antenna switch.
3. The AT-120 is designed to be used on the Amateur bands between 3.5 MHz and 30 MHz.
4. Antenna MATCHING or THROUGH operation is BAND-switch selected.
5. The SWR meter operates in both THROUGH and MATCHING modes.
6. A mounting bracket is included for mobile operation.
7. The panel meter can be illuminated by an external power source.
8. The antenna matching circuit is effective in reducing TVI since it acts as a band-pass filter.

CIRCUIT DESCRIPTION

Directional Coupler

The directional coupler samples forward and reflected power from the transceiver to the load.

Meter Circuit

The forward and reflected power sampled by the directional coupler is used for SWR measurement. Forward power is calibrated with the CAL control so the meter reads reflecte poweer as SWR.

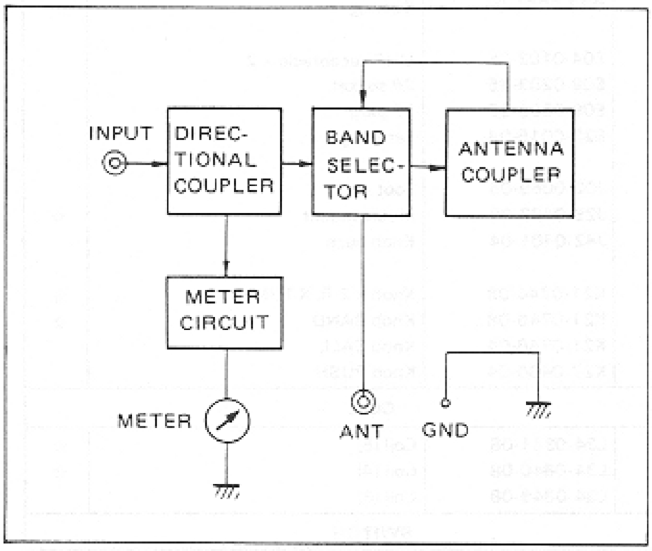
Band Selector Switch

This selects the band to which the matching circuit is tuned. In the "THROUGH" position, the antenna is connected directly to the transceiver, by passing the coupler, while still allowing SWR measurement.

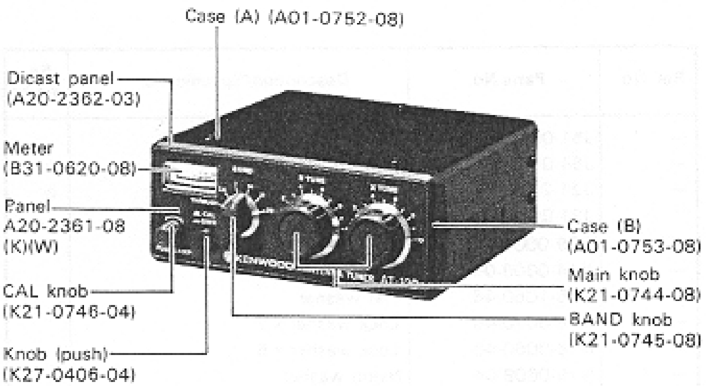
Antenna Coupler

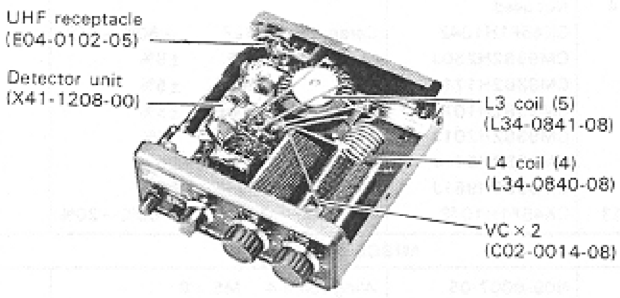
The universal matching circuit is capable of matching 20 to 300Ω loads to the 50Ω input impedance.

BLOCK DIAGRAM



EXTERNAL VIEW/INTERNAL VIEW





AT-120 PARTS LIST/MB-100

Mark: New Parts

Ref. No.	Parts No.	Description	Re-marks
		GENERAL	
–	A01-0752-08	Case (A)	☆
–	A01-0753-08	Case (B)	☆
–	A20-2360-08	Panel (T)	☆
–	A20-2361-08	Panel (K) (W)	☆
–	A20-2362-03	Dicasting panel	☆
–	B31-0620-08	Meter	☆
–	B31-0058-00	Warranty card (K)	
–	B50-2667-08	Operating manual (K) (W) (T)	☆
–	B51-0875-00	Service manual (K) (W) (T)	☆
–	D23-0061-04	Bearing	
–	E04-0102-05	UHF receptacle × 2	
–	E08-0203-25	2P socket	
–	E09-0203-25	2P plug	
–	E23-0015-04	Earth lug × 3	
–	J02-0069-05	Foot	
–	J29-0402-08	Moble maunt	☆
–	J42-0401-04	Knob bush	
–	K21-0744-08	Knob × 2 R, X TUNE	☆
–	K21-0745-08	Knob BAND	☆
–	K21-0746-04	Knob CALL	
–	K27-0406-04	Knob PUSH	
		COIL	
3	L34-0841-08	Coil (5)	☆
4	L34-0840-08	Coil (4)	☆
5	L34-0849-08	Coil (6)	☆
		SWITCH	
–	S01-3404-08	Rotary switch	☆
–	S40-2403-05	Push Switch	
		VC/POTENTIOMETER	
C1,2	C02-0014-08	Variable capacitor × 2 250pF 1KV	☆
–	R05-3406-08	Variable resistor 20 kΩ (B)	☆
		CAPACITOR	
1 ~ 4	Not used		
5	CK45F1H104Z	Ceramic 0.1μF +80% −20%	
6	CM93B2H250J	Mica 25pF ±5%	
7	CM93B2H171J	Mica 170pF ±5%	
8	CM93B2H101J	Mica 100pF ±5%	
9	CM93B2H201J	Mica 200pF ±5%	
10	CM93B2H341J	Mica 340pF ±5%	
11	CM93B2H951J	Mica 950pF ±5%	
12,13	CK45F1H104Z	Ceramic 0.1μF +80% −20%	
		MISCELLANEOUS	
–	N09-0007-05	Wing volt × 4 M5 × 8	
–	N14-0509-05	Wing nut	
–	X41-1208-00	Detector Unit	☆
–	H01-2633-08	Carton (T)	☆
–	H01-2634-08	Carton (K) (W)	☆
–	H12-0461-08	Cushion	☆

DETECTOR UNIT (X41-1208-00)

Ref. No.	Parts No.	Description	Re-marks
C1,2 C3,4	CM93B2H150J CK45F1H104Z	Mica 15pF ±5% Ceramic 0.1μF +80% −20%	
R1,2	PD14BB2E510J	Carbon resistor 51Ω ±5% 1/4W	
L1,2	L39-0403-08	Detector coil	☆

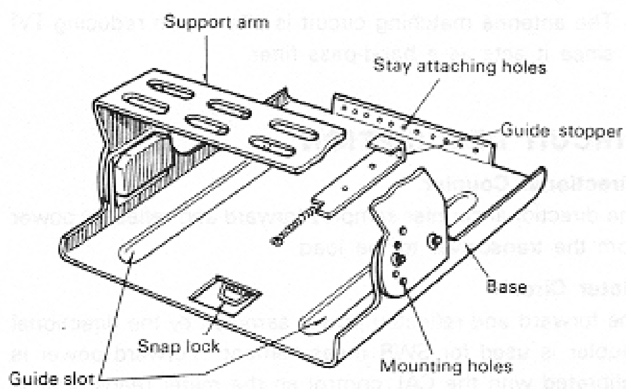


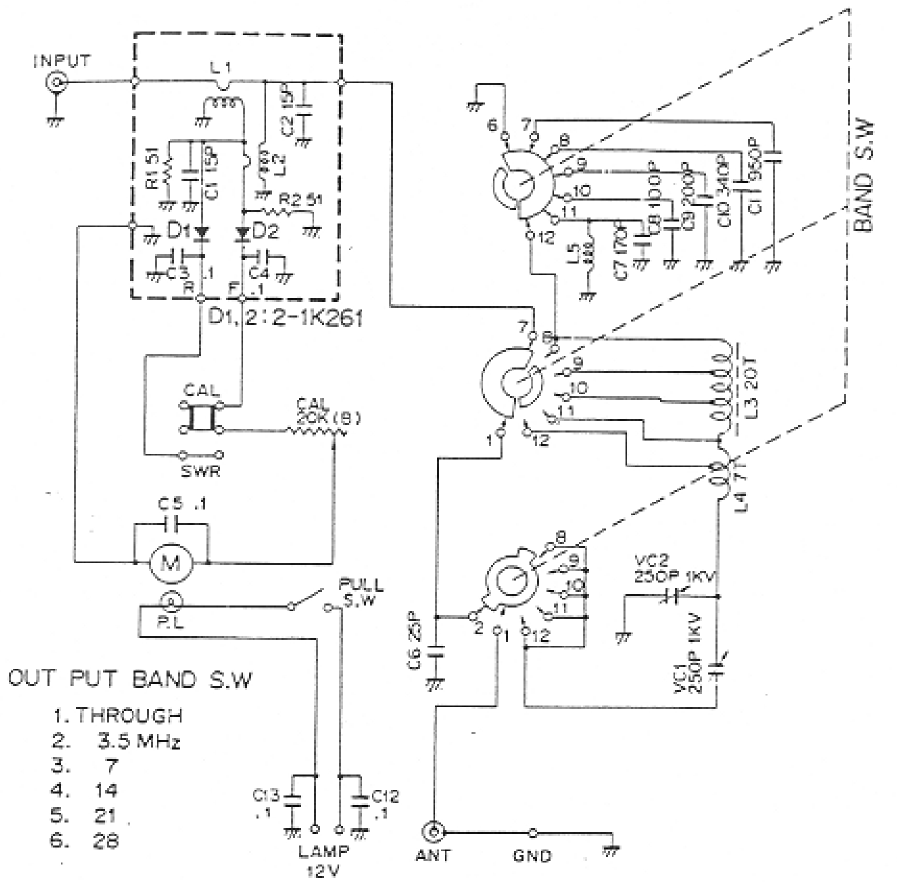
Fig. 21 MB-100 Installation location

Ref. No.	Parts No.	Description/Specification	Re-marks
–	J51-0006-15	Snap lock	
–	J54-0401-14	Stay × 2	☆
–	J21-2633-04	Guide stopper	☆
	J21-0401-04	Guide stopper (V)	
–	N09-0008-04	6mm Hex. Screw × 6	
–	N14-0009-04	6mm Nut × 6	
–	N15-1060-46	Flat washer	
–	N16-0040-46	Lock washer × 2	
–	N16-0060-46	Lock washer × 6	
–	N19-0609-04	Nylon washer	☆
–	N30-4008-46	Screw	
–	N32-3006-46	Flat head screw	
–	N87-3006-46	Round head phillips self tapping screw × 2	
–	N88-3006-46	Flat tap light tight screw × 2	
–	N99-0304-04	Hex. head screw × 6	
–	W01-0401-04	Hex. wrench	

AT-120 SCHEMATIC DIAGRAM/SPECIFICATIONS

NOTE: The circuit and ratings may change without notice due to developments in technology.

SCHAMATIC DIAGRAM



SPECIFICATIONS

1. Antenna Coupler

Frequency range:	5 amateur bands from 3.5 to 29.7 MHz
Input impedance:	50Ω
Output impedance:	20 to 300Ω, unbalanced.
Through power:	150 W max. (3.5 MHz band, 120 W)
Insertion loss:	Less than 0.5 dB at optimum match.

2. SWR Meter

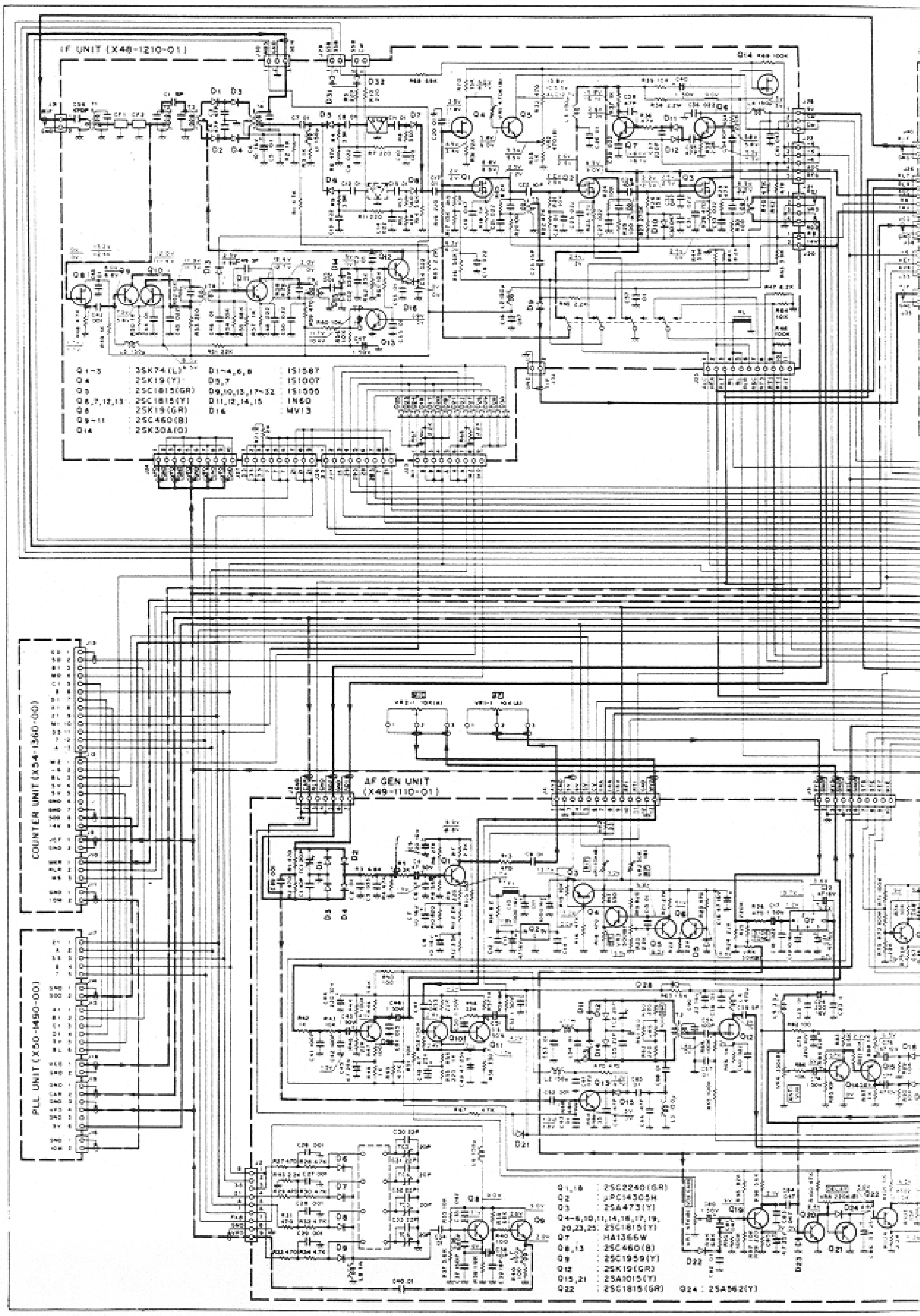
Frequency range:	3.5 to 29.7 MHz
Max. power:	150 W
Measurable range:	1.0:1 to 10:1
Min. power required:	2 W

3. General

INPUT Connector:	UHF type (50Ω)
ANT Connector:	UHF type (50Ω)
GND:	Wing nut and STUD.
Dimensions:	152 (6) W × 60 (20-3/8) H × 159 (6-1/4) D mm. (inch)
Weight:	1.6 kg (3.5 lbs) approx.

SC

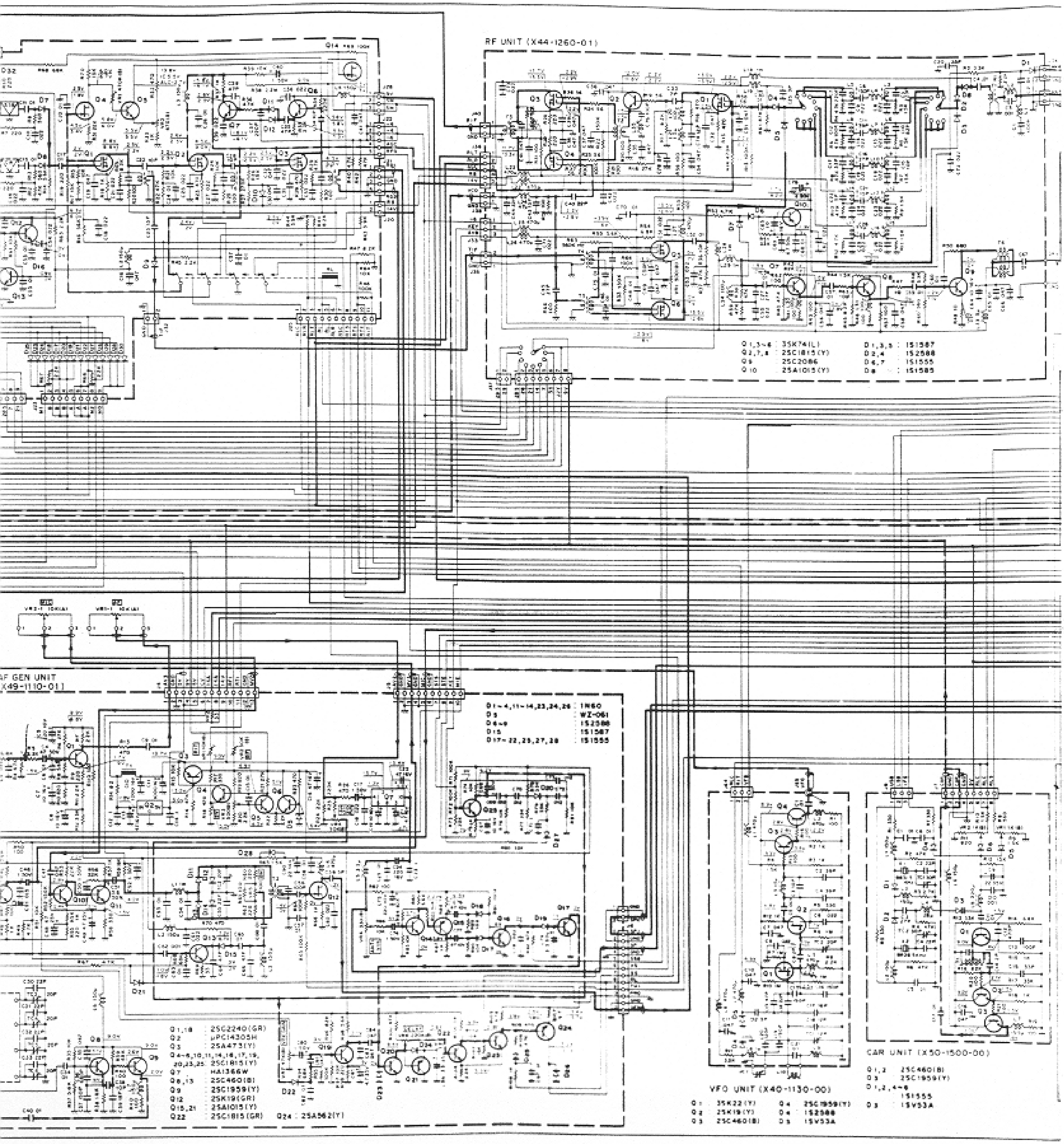
TS-120-S



IF UNIT (X48-1210-01)
Q1~3 : 3SK74(L)
Q4 : 2SK19(Y)
Q5 : 2SC1815(GR)
Q6,7,12,13 : 2SC1815(Y)
Q8 : 2SK19(GR)
Q9~11 : 2SC460(B)
Q14 : 2SK30A(O)
D1~4,6,8 : 1S1587
D5,7 : 1S1007
D9,10,13,17~32 : 1S1555
D11,12,14,15 : 1N60
D16 : MV13
COUNTER UNIT (X54-1360-00)
PLL UNIT (X50-1490-00)
AF GEN UNIT (X49-1110-01)
Q1,18 : 2SC2240(GR)
Q2 : μPC14305H
Q3 : 2SA473(Y)
Q4~6,10,11,14,16,17,19,20,23,25 : 2SC1815(Y)
Q7 : HA1366W
Q8,13 : 2SC460(B)
Q9 : 2SC1959(Y)
Q12 : 2SK19(GR)
Q15,21 : 2SA1015(Y)
Q22 : 2SC1815(GR)
Q24 : 2SA562(Y)

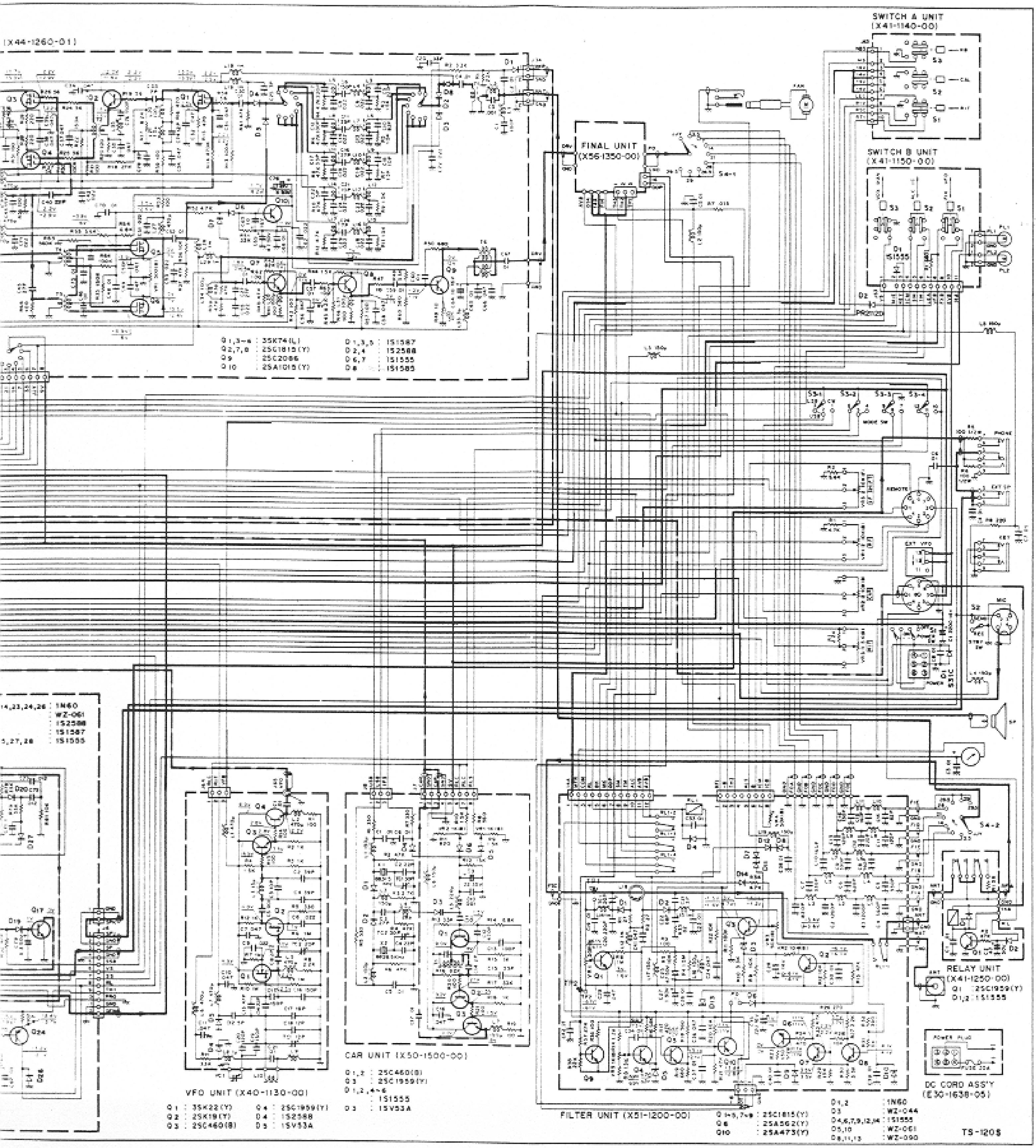
SCHEMATIC DIAGRAM

TS-120-S

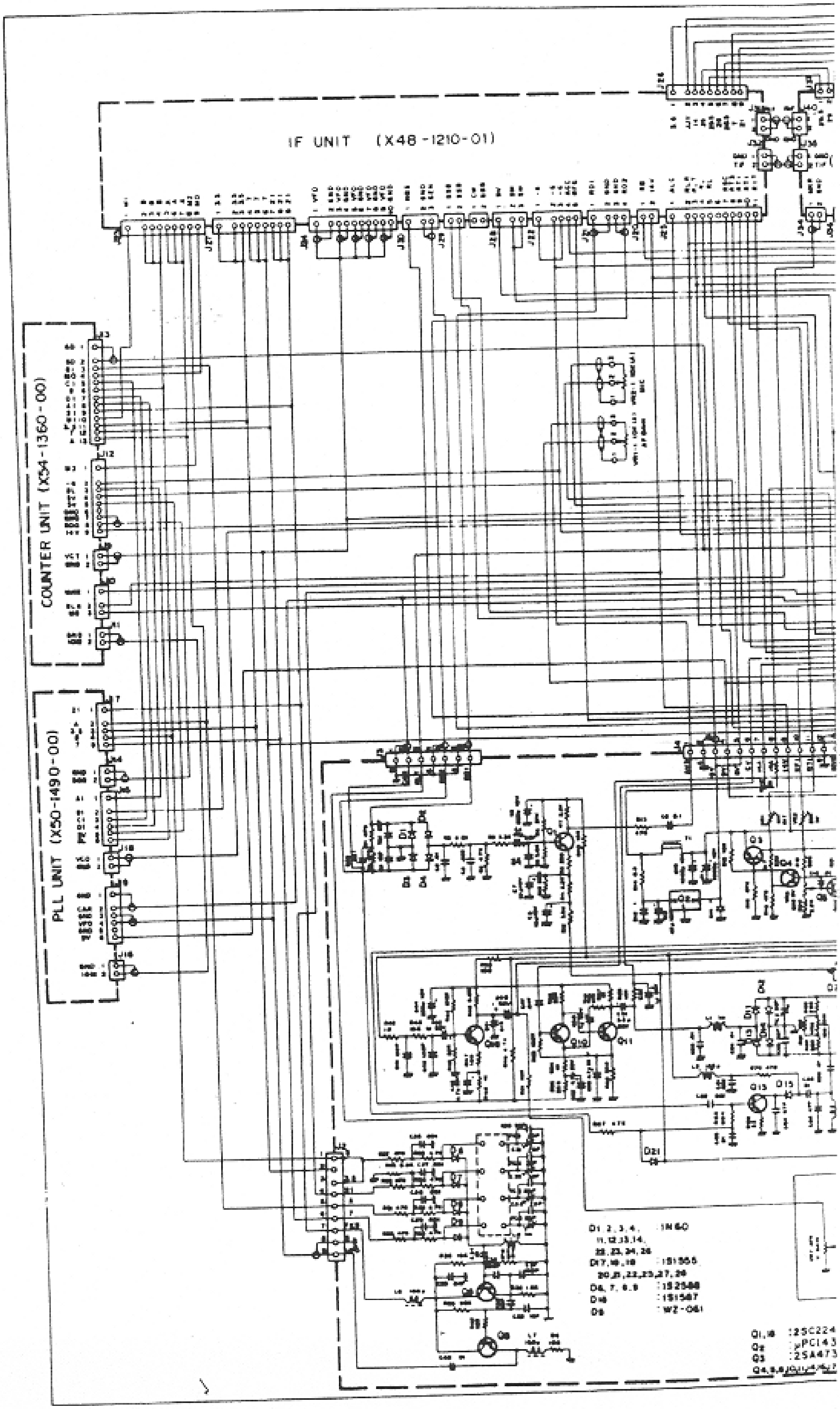


MATIC DIAGRAM

TS-120-S

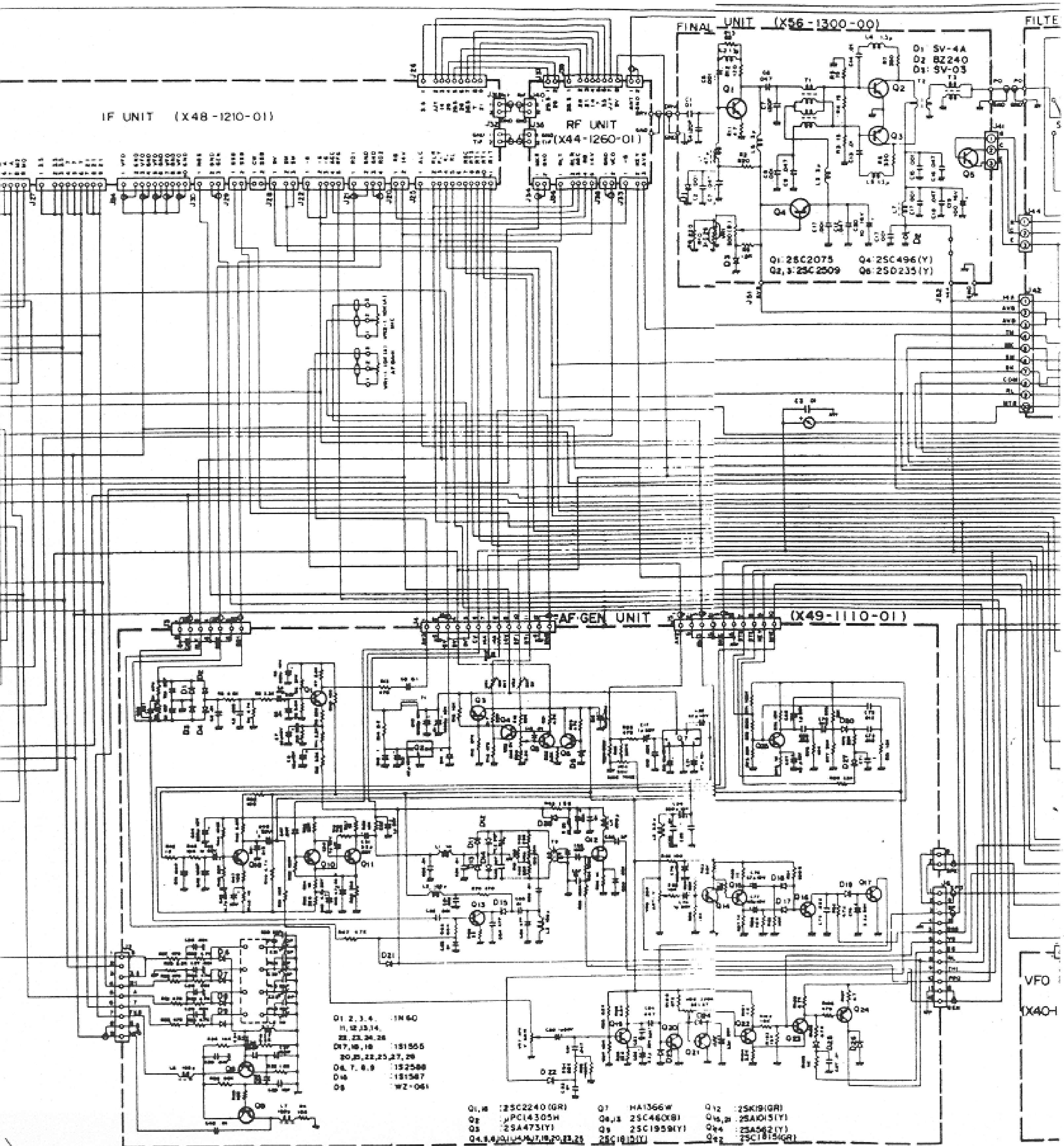


TS-120



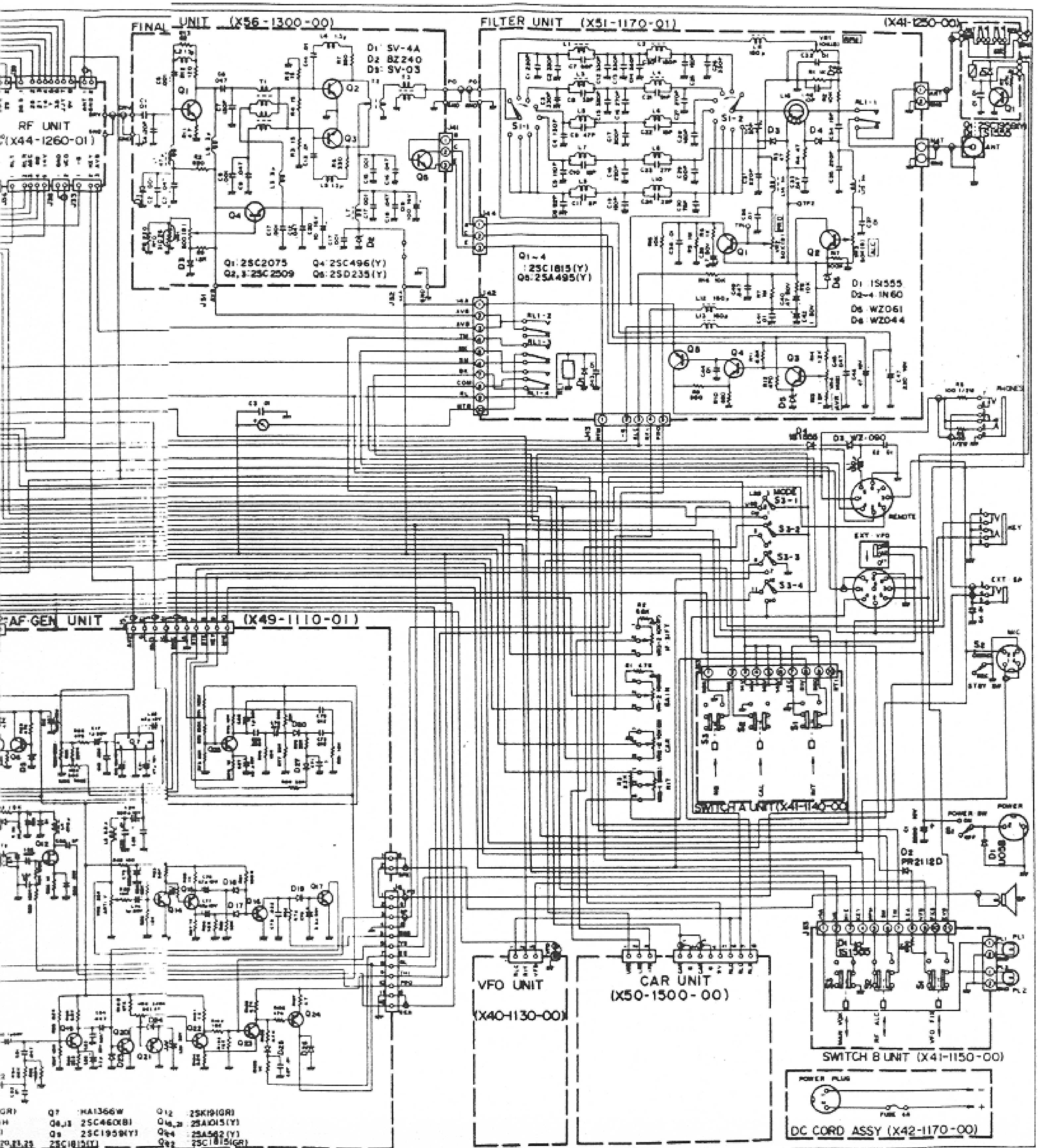
TS-120V

TS-120V SCHEMATIC DIAGRAM



TS-120V

0V SCHEMATIC DIAGRAM



TS-120V

A product of
TRIO-KENWOOD CORPORATION
6-17, 3-chome, Aobadai, Meguro-ku, Tokyo 153, Japan

TRIO-KENWOOD COMMUNICATIONS, INC.
1111, West Walnut Street, Compton, California, 90220, U.S.A.
TRIO-KENWOOD COMMUNICATIONS, GmbH
D-6374 Steinbach TS, Industriestrasse 8A, West Germany
TRIO-KENWOOD(AUSTRALIA)PTY. LTD.
30 Whiting Street, Artarmon, Sydney N.S.W. Australia 2064